Appendix H
Conceptual Design for
Chief Joseph Dam
Hatchery Program
Monitoring and Evaluation Program

Conceptual Plan

For the Three-Step Master Planning Process

Integrated Monitoring and Evaluation Program

for the

Chief Joseph Dam Hatchery

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Prepared for the Colville Tribes

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Table of Contents

INTRODUCTION

Need, Value and Conceptual Approach

Production of salmon and steelhead at hatchery facilities reflect a considerable investment in public funds and has implications that can extend far into the future for the region, stakeholders, and specific to the Chief Joseph Hatchery Program (Hatchery Program), tribal economics and culture. For these reasons, hatcheries need to be operated in a manner where successes and failures are monitored, evaluated, and responded to by managers accountable for their success or failure.

Equally important will be results to inform the region and those who are directly responsible to manage the fishery resource in a sustainable manner. Thus, this Conceptual Monitoring and Evaluation (M&E) program points to a shift in emphasis from facilities and hatchery operations to monitoring and evaluating the influence supplementation has on fish populations and ecosystems in the field.

This conceptual plan will outline a strategy for addressing multiple categories and include guidance derived from the Northwest Power and Conservation Council, NOAA fisheries, Hatchery Genetic Management Plans and the Independent Scientific Advisory Board's recommendations on M&E programs at supplementation facilities. We will identify a discrete set of goals and objectives and will then describe a preliminary study design and methods to accomplish each of the major objectives. As the hatchery Master Plan (3-Step) process advances, additional detail including annual work plans, fiscal year budgets, reporting standards, and data management procedures and architecture will be incorporated.

This Conceptual Plan will provide guidance for performance standards in the following categories:

- Legal Standards
- Conservation Standards
- Life History Characteristics
- Genetic Characteristics
- Research Activities
- Operation of Artificial Production facilities
- Socio-economic effectiveness
- Harvest Standards
- Non-target population impacts
- Target population production
- Target population long-term fitness

To this end, indicators and performance standards that directly or indirectly relate to success or failure are defined in this conceptual plan. We provide a framework

description aimed at implementing the appropriate statistics and study designs to the extent they are applicable to the landscape and project scope. We also describe how results must be managed, evaluated, and effectively communicated, such that informed and responsive decisions can be made at all levels of management and operation to facilitate and effectively transfer the knowledge gained.

In 2001, the Colville Tribes submitted a monitoring plan to the Northwest (then the…[P]ower Planning Council) Power and Conservation Council and Bonneville that included the US/Canada Okanogan/Okanagan and the Similkameen River basins. This plan has been strongly endorsed in 2001 by the ISRP as a "model" for the entire Columbia Basin and is used extensively by reference in the Pacific Northwest Aquatic Monitoring Partnership's "Guidance to Subbasin Planners." The Baseline Monitoring and Evaluation Program (the Baseline M&E), is now collecting data on many, but not all, of the performance indicators for this program. Consequently, and as part of the Master Planning process, the Colville Tribes have prepared this Conceptual (the Hatchery M&E) Plan to describe, in general, the scope of efforts and range of supplementary information needed to detect and report overall program performance as described in HGMPs

These integrated efforts will begin to provide essential information on habitat conditions, capacity and fish populations, beginning in 2004. The information derived will then be used to detect the effectiveness (or lack thereof) of the hatchery production and supplementation and the integrated harvest and recovery programs as each element comes on line. This will allow us to operate our facilities in a manner consistent with efforts to detect the trends and effectiveness between and among other subbasins, ESUs, and across a broader group of "H's" and planning processes. Previously unattained levels of cost-effectiveness, standardization of performance metrics and crosscut data and communications management, represent the by-products and benefits of this coordinated approach.

A key issue to be fully evaluated is the appropriate number and location of hatchery-origin fish releases. Achieving the goals of joint Integrated Recovery and Integrated Harvest programs will require collection and evaluation of a wide variety of information on fish interactions, productivity rates of hatchery-origin and natural-origin populations, and harvest effects. The Colville Tribes realize that initial production numbers will likely change and the programs adapt as M&E occurs. Of particular note is the need for information that could guide adjusting fish release numbers between sites on the Okanogan River and the hatchery, directly below Chief Joseph Dam, to balance the two programs.

Thus, the Hatchery M&E Plan will be synchronized and integrated with the Okanogan[1] Baseline Monitoring and Evaluation Program (BPA project No. 200302200). These linked plans will be key documents in the final Master Plan, the Okanogan Subbasin Plan and State of Washington's Salmon Recovery Plan(s); the latter forming a strong

[1] Colville Tribes 2004. Design and Conduct Monitoring and Evaluation Associated with Re-establishment of Okanogan Basin Natural Production.

basis for recovery planning under the Endangered Species Act[2]. Because this Hatchery Evaluation Plan is closely coordinated with the Okanogan Baseline Plan[3], the two must be viewed together to discern the full scope of effort that will be brought to bear in support of the hatchery's integrated programs. Both plans will combine to provide the necessary information for determining the success or failure of production and recovery programs in the Okanogan River basin

This plan supports the premise that salmon (bull trout and steelhead) recovery is a race between the time a population or group of populations will be extirpated and the time habitat to support those populations can be recovered. Whether supplementation is appropriate for a population depends on the anticipated time to extirpation compared to the time required for habitat recovery. Supplementation should be considered appropriate if a population would be extirpated before habitat could be recovered, and, if the habitat could be recovered in the extended period, that supplementation could provide. Given this line of reason, and a vision reflective of the unmitigated history of losses caused by hydropower, agricultural and industrial development in the main stem, valley bottom, and tributary areas across our trust lands, the Colville Tribes conclude that the current state-of-affairs for fish populations and their ecosystems in the Okanogan unequivocally corresponds to this fundamental premise.

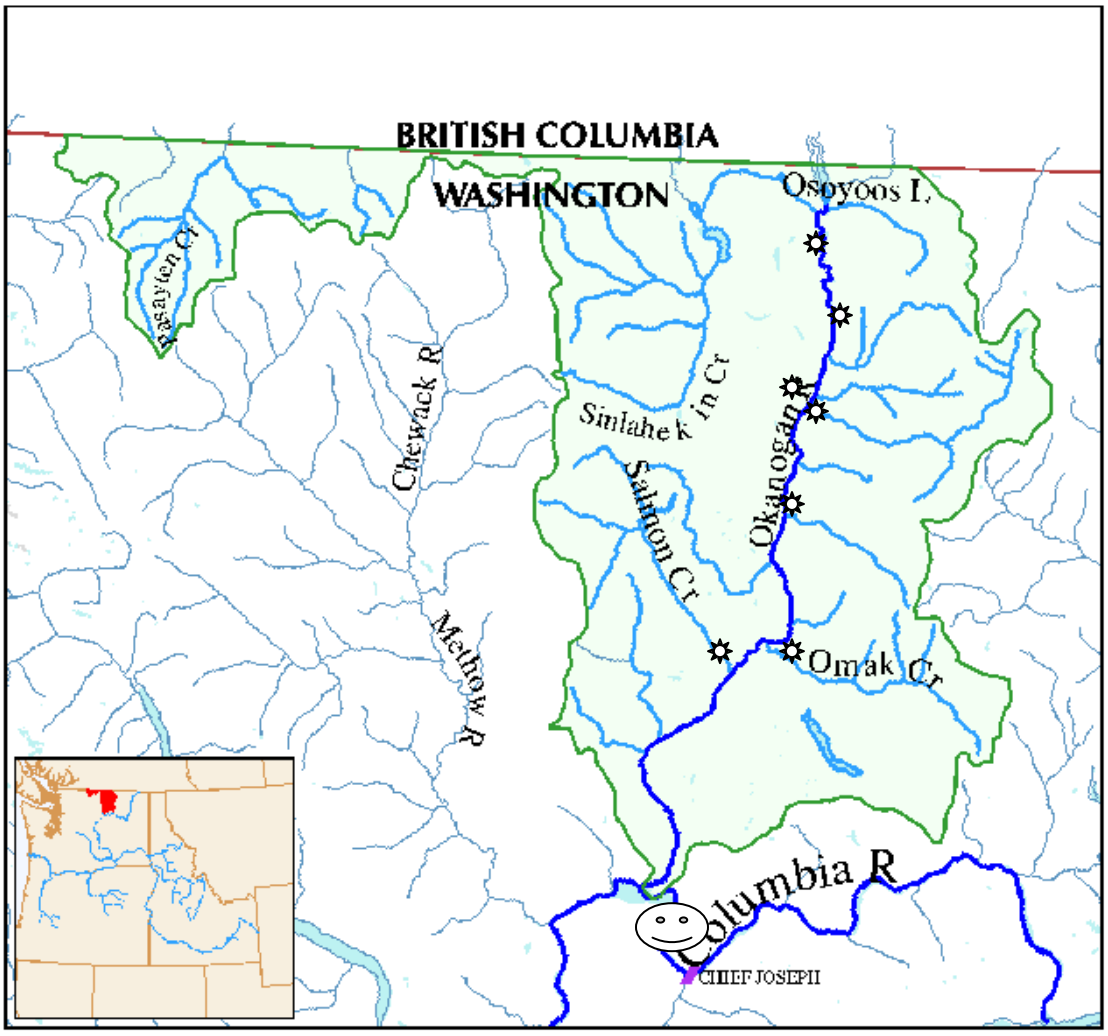
In closing, it is reasonable to argue that no other region in the Columbia Basin exemplifies the need for strategic, comprehensive, and substantive actions more poignantly or literally than the combined territory of the Okanogan River Basin[4], the Columbia Cascade Province, and the Upper Columbia ESU. The effort to reestablish viable native fish populations and sustainable natural production habitats in this region will fail without cumulative (positive) effects derived from habitat improvement and protection, implementation of appropriate harvest rates, reductions in mortality associated with hydropower operations and facilities, and (in combination with), the effective and judicious use of artificial production.

[2] January 2004 letter from Bob Lohn (NOAA) to Governor Gary Locke (WA) stating that the State Plan Outline will meet ESA recovery plan requirements.
[3] The baseline plan uses EPA's EMAP protocol and is further derived from the BPA-funded M&E Pilot Study developed for the Wenatchee subbasin, and adopted by all subbasins in the Upper Columbia (Upper Columbia Regional Technical Team/Upper Columbia Salmon Recovery Board and Hillman et.al.,).
[4] Hereinafter referred to in sum as the Okanogan subbasin including Omak and Salmon Creeks, those portions of the Similkameen below Enloe dam, and Canadian areas comprising the main stem Okanogan, McIntyre, Inkaneep, and Shingle Creeks, Osoyoos, Vaseux, Skaha Lakes, Lake Okanagan and their major tributaries having present or historical anadromous use.

Figure 1. Okanogan River Subbasin (Canadian portion not fully depicted at this time)

☼ Location of existing and proposed acclimation sites

Location of proposed Chief Joseph Dam Hatchery



EXPERIMENTAL DESIGN CONSIDERATIONS

Supplementation studies require large financial investments over prolonged periods and potentially have major policy impacts for resource management and development. As such, a supplementation experiment should involve good experimental design so that there is confidence in the conclusions.

Supplementation studies involve:

1. Large open ecological systems (rivers) that have been extensively disturbed through time, plus artificial production systems (hatcheries) that also change;

2. Inherently variable natural systems involving multiple factors in freshwater and marine environments;

3. Long timeframes with expected changes in environments through time (time treatment interactions, Walters and Holling 1990);

4. Impossibility to truly replicate experimental units in Nature; and

5. Limitations on the allocation of treatment and references experimental units.

These challenges in ecological studies were well described in Hurlbert 1984. Hurlbert's description of critical features of a controlled experiment identified four design features: controls (i.e., references), replication, randomization, and interspersion.

"An experiment is successful to the extent that these factors are prevented from rendering its results inconclusive or ambiguous. It is the task of experimental design to reduce or eliminate the influence of those sources of confusion".

Given these challenges, three general issues become paramount in designing a supplementation study and provide guidance to this conceptual plan. To address these issues:

1. We will seek to determine what response variables can be measured, how to compare treatments, and how to estimate the variability in those response variables.

2. We will consider if strict adherence to statistical inference is necessary, and if not, we will determine what evidence will be adequate for comparison of treatments.

3. We will consider whether other experimental designs are appropriate to the study.

The last issue may involve adaptive management designs or temporal interventions (see Walters 1986, Walters et al. 1988) or designs recently presented by Oksanen (2001).

The Final Hatchery M&E Plan will include description of the monitoring, evaluation, and experimental designs needed to evaluate the effectiveness of measures taken to meet the goals and objectives. Following are the conceptual components of these elements.

PROTOCOLS, METHODS AND STANDARDS

Uncertainties

There are several potential sources of error or confusion that need to be acknowledged, understood and addressed if possible in M&E programs. Some examples are:

Table 1. Examples of potential error, bias, or confusion in M&E programs.

	Source of error, bias or confusion	**Methods to reduce or eliminate**
1	Temporal change	Control treatments
2	Procedure bias	Control treatments
3	Experimenter bias	Randomization assignment of experimental units to treatments, and other procedures
4	Experimenter generated variability (random error)	Replication of treatments
5	Initial or inherent variability among experimental units	Replication of treatments. Interspersion of treatments. Concomitant observations.
6	Intrusions (impingement of chance events on an experiment in progress)	Replication of treatments. Interspersion of treatment

ISAB Elements

The following are listed by the ISAB as typical Columbia River Basin supplementation program elements as necessary for adaptive management and provide guidance on estimation parameters and vital statistics:

Program Guidelines

1. Broodstock Source
2. Original Broodstock Collections
3. Subsequent Brood Collection
4. Proportion of Natural Population that can be collected for broodstock
5. Proportion of naturally spawning population that must be of natural-origin

Performance Standards

1. Hatchery Rearing Survival
    a. Broodstock Survival
    b. Egg To Release
    c. SAR
2. Hatchery Production Targets
    a. Broodstock Collection
    b. Smolt Release
    c. Adult Release
    d. Harvest Contribution
    e. Spawning Contribution
3. Natural Population Production Targets
    a. Adult Abundance

Facilities to Enumerate Fish

1. Adult Counts
    a. Trap and/or Count Entire Run
    b. Trap and Count Part of Run
    c. Spawning Ground Survey/Sample

2. Broodstock Collections
    a. Weir/trap below all spawning grounds
    b. Weir/trap collects only target stocks
3. Juvenile Trapping/Counting
4. Reference Populations

Vital Statistics Record

1. Hatchery Produced
    a. No. of natural broodfish collected by sex and age
    b. No. of hatchery broodfish collected by sex and age
    c. No. of natural broodfish spawned by sex and age
    d. No. of hatchery broodfish spawned by sex and age
    e. Pre-spawning survival
    f. Egg to release survival
    g. Smolt to adult return survival (SAR)
    h. Adult recruit per spawner ratio

2. Naturally Produced
    a. No. of natural-origin adults in the spawning escapement by sex and age
    b. No. of hatchery-origin adults in the spawning escapement by sex and age
    c. Pre-spawning survival
    d. Smolt population estimate
    e. Natural egg to smolt survival

f. Smolt to adult return survival (SAR)
g. Adult recruit per spawner

Parameters Needed to Assess the Demographic Consequences of Supplementation

The purpose of this section is to identify the full range of parameters such that we can assess the existing scope of the Baseline Program, the Hatchery M&E Program and relative costs of modeling production dynamics as described by Goodman.

Several parameters are required to assess the production dynamics of supplementation (based on the Goodman model). Obtaining the data needed to estimate these parameters, however, can be difficult and expensive. The text below describes these parameters, required data, and concerns related to collection of data. In the notation below, the letter, "**w**" designates fish produced naturally and/or it designates a natural environment, and the letter "**a**" designates fish produced in a hatchery and/or it designates a hatchery environment.

Nw(t) designates the number of naturally spawning fish in generation (t) that were produced from naturally spawned parents (i.e., typically unmarked). Data are required to estimate the total population size of natural spawners by stream (or spawning locale), age, and sex. Sampling designs must define the confidence level desired, because high levels of confidence will require extensive sampling efforts. For example, population size by age and sex usually requires sampling for a minimum of six categories in multinomial sampling. While it is not necessarily required, the fecundity by population and age/size categories should also be estimated because it may differ with environmental and genetic background.

In the model, naturally produced fish may subsequently spawn in the natural population (i.e., parameter **Nww(t)** and some may be removed for broodstock in a hatchery (i.e., parameter **Naw(t).**

Na(t) designates the number of hatchery origin fish in generation (t) that were produced by hatchery-reared parents (i.e., may be identifiable by mass marking). Data are required to estimate the total population size of returning hatchery fish, including the sampling efforts as defined for **Nw(t**).

In the model, hatchery-produced fish may subsequently spawn in the natural population (i.e., parameter **Nwa(t)** and some could be used as broodstock in a hatchery (i.e., parameter **Naa(t).**

For each of the four potential population segments (**Nww, Naw, Nwa, Naa**) estimates of numbers by age and sex categories should be maintained to examine sampling biases. In addition, care must be taken as to when sampling and removals occur.

Fw is the fraction of the adult run of fish (after harvest removals) grown from naturally spawned eggs removed for broodstock. Note that **Fw** is expressed as a fraction of the total return of naturally produced fish in a year, but it may not accurately represent the fraction of the effective spawning population if pre-spawning mortality or unaccounted mortalities occur in the natural population.

Fa is the fraction of the adult run of fish (after harvest removals) grown from hatchery spawned eggs removed for broodstock. As above, **Fa** may not be representative of the effective spawning population of hatchery returns, particularly if the reproductive potential of the hatchery-produced fish is reduced in natural environments.

H designates the portion of the hatchery population removed by harvest (i.e., **Ha**). Fishing mortality on naturally produced fish is accounted for through the parameter "**s**", the **harvest selectivity** relative to **H**. The fraction of the adult run of naturally produced fish that is taken as harvest (estimated before broodstock removal) is estimated as **(1-s)** times **H**.

Unless the harvest selectivity of natural fish equals one (i.e, no differential selectivity or mortality between hatchery and naturally produced fish), then the estimation of "**s** " requires: (a) estimates of the relative encounter rates of hatchery and natural fish, and (b) the expected mortality rate to associate with fish released from the fishing gear. These mortality rates will vary between species, gear types, and handling procedures. Also, if harvest occurs in an area that holds fish and/or fishing occurs over an extended period, then the parameter "**s** " likely needs to be estimated by time interval since the encounter rate or ratio of hatchery: wild fish will change over time.

H also includes the potential mortalities in ocean fisheries. Ocean harvest impacts could be ignored if there were no mass- marked selective fisheries in the ocean. If so, some parameters estimated would be biased low (replacement rate), but the relative error in hatchery and natural sub-populations would be equal. However, if there are selective fisheries for marked-hatchery fish, then the ocean mortalities will not be equal between the hatchery and naturally produced fish. These fisheries would involve direct removal of mass- marked hatchery fish and incidental mortality on natural fish. With selective mass-mark ocean fisheries an unbiased estimate of ocean exploitation rates for unmarked natural fish cannot be estimated unless there are tagged components (usually CWT) of both stocks (mass-marked hatchery and natural), see SFEC 2002[1]. If there is ocean exploitation or terminal harvest (Ha) that would have associated mortalities on naturally produced fish, then ***a paired tagging program*** is required to estimate the incidental morality rate on the naturally spawned fish.

The two critical biological parameters for the model are:

Rw, the intrinsic replacement rate for a naturally spawned generation (i.e., adult return rate per spawner from each spawning year).

Data needs are:

i. **Nww(t)**, fish that were produced naturally and spawn naturally in the next generation, sex ratio and age of spawners, and fecundity (female eggs per female by age class), pre-spawning mortality rate and effectiveness of spawning; tag groups.

ii. **Nwa(t)**, fish that spawn naturally but were produce in a hatchery in the previous generation, sex ratio and age of spawners, and fecundity (female eggs per female by age class), pre-spawning mortality rate and effectiveness of spawning;

iii. Effective egg deposition in the natural environment is the sum of (i) and (ii);

iv. Number of emigrating naturally-produced parr and smolts from the population/geographic area of interest; and

v. The number of returning adults by age and sex (also size if varying and affecting fecundity or effectiveness of spawning). Researchers will need to consider how to account for small mature male adults that may return. These fish are typically a year younger than the first age of mature females and can account for a significant portion of the terminal runs in some stocks and years.

We recommend that the enumeration of adults and estimation of Ra and Rw be conducted on females. This would circumvent the conceptual and practical difficulty of treating precocials and jack males in the production model.

Ra, the intrinsic replacement rate for a hatchery-produced generation (i.e., adult return rate per spawner from each spawning year). Data needs are:

i. **Naa(t) and Naw(t)**, by sex and age class, and fecundity (female eggs per female by age/size class)

ii. Number of eggs laid by year

iii. Number of smolts produced from a spawning year

iv. Number of returning adults by age and sex (also size if varying and affecting fecundity or effectiveness of spawning). See comments in paragraph (v) above.
While the parameters identified above (bold) are sufficient for the supplementation model, other variables may influence our ability to estimate the parameter values, or to explain differences between them.

These variables may include:

a) Inter-dam loss rates by age/size class or stock
b) Downstream mortality rates by size class or time period
c) Changes in ocean exploitation rates versus marine survival

d) Distribution of hatchery returns (i.e., straying of hatchery releases versus homing fidelity of the natural fish)
e) Accounting for uncertainty in parameter estimates, including the assumption of fixed natural mortality rates between ages in the ocean (typically applies to Chinook assessments more than other species).

Assessment Methods

To reconstruct the number of fish surviving to an age, data are needed for each age from at least the following life stages:

1. Egg and incubation
2. Active rearing
3. Over-wintering
4. Active migration (juvenile and adult)
5. Pre-spawning
6. Spawning

Indicators and Variables

Criteria for selecting variables were based on the following characteristics:

- Indicators should be sensitive to land-use activities or stresses.
- They should be consistent with other regional monitoring programs.
- They should lend themselves to reliable measurement.
- Physical/environmental indicators would relate quantitatively with fish production.

The indicators selected by the Action Agencies/NOAA Fisheries were also consistent with "key" parameters used in the Ecosystem Diagnosis and Treatment model used in the Okanogan as the primary planning and analytical modeling tool.

The final M&E plan will provide:

1. A written protocol for complete statistical analysis, certified by an independent statistician team presented to Council during the Master Plan period.

2. The protocol for statistical analysis indicating how straying of hatchery fish into "control streams" and "partial treatments" will be analyzed.

3. A specific stream-by-stream protocol and timetable for implementation.

Biological Indicator Variables

The Baseline M&E Plan and Hatchery M&E Plan will be integrated to measure the biological indicator variables described below. Table 2 provides a summary description of the assessment methods to be used.

Adults

Escapement

The plan includes escapement of mature adults as an important biological indicator of population health. "Total" escapement is the total number of mature adults that enter or occur within a stream or watershed. "Spawning" escapement is the number of adults that spawn in a stream or watershed. Numbers of mature adults within a stream or watershed is a function of all the factors that affect the life history of the population.

Spawners

The plan includes six indicators associated with the characteristics of the spawning populations: age structure, size, sex ratio, origin, genetics, and fecundity. Age structure describes the ages of adult fish within the spawning population. For anadromous species, age structure includes the number of years the fish spent in freshwater and number of years in salt water. Size describes the lengths and weights of adult fish within the spawning population. Sex ratio is the ratio of males to females within the spawning population. Origin identifies the parentage (hatchery or wild) of individuals within the spawning populations, while genetics defines not only the parentage but also within and between population variability. Fecundity is the number of eggs produced by a female.[5]

Redds

Abundance/Distribution

Abundance describes the number of redds of fish species within a subbasin. Total numbers (based on a complete census) will be estimated for fall-spawning anadromous species, while numbers of redds of other species (e.g., steelhead and sockeye) will be estimated within index areas and sites selected randomly (following EMAP). Distribution indicates the spatial arrangement (e.g., random, even, or clumped) and geographic extent of redds within the basin.

[5] By definition, *fecundity* refers to the number of eggs readied for spawning by a female (Royce 1996). *Relative fecundity* is the number of eggs per unit of weight, while *total fecundity* is the number of eggs laid during the lifetime of the female. This plan refers to fecundity as the number of eggs per size (length and weight) of female.

Parr

Abundance/Distribution

Abundance describes the number of juvenile fish within specified stream reaches. Distribution is the spatial arrangement of juvenile fish within populations. It also captures the geographic range of individuals within the watershed or basin.

Condition

The condition (or well-being) of fish can be assessed by measuring the length (fork length for salmonids, FL mm; total length for all other species, TL mm) and weight (g) of juvenile fish. The plan includes Fulton-type condition as the metric for well-being of juvenile fish (Anderson and Neumann 1996). The Fulton-type condition factor is of the form:

$$K = (W/L^3) \times 100{,}000,$$

Where K = Fulton-type condition, W = weight in grams, and L = length in millimeters. The constant 100,000 is a scaling constant used to convert small decimals to mixed numbers so that the numbers are more easily comprehended.

Smolts

Abundance:

Abundance of smolts is an estimate of the total number of smolts produced within a watershed or basin. The estimate should be for an entire population or subpopulation.

Condition:

The Fulton-type condition factor describes the well-being of smolts within a population or subpopulation.

Genetics:

Genetic characterization (via DNA microsatellites) describes within- and between-population genetic variability of smolts.

Macro-invertebrates

Transport:

The plan includes export of invertebrates (aquatic and terrestrial) and coarse organic detritus from headwaters to habitats downstream as an important attribute of productivity. The movement of prey items and organic detritus among habitats has a strong influence on fish populations, food webs, community dynamics, and ecosystem processes (Wipfli and Gregovich 2002).

Composition:

The plan includes benthic macroinvertebrate composition as an important indicator of aquatic invertebrates in streams. Benthic macroinvertebrate assemblages in streams reflect overall biological integrity of the benthic community. Because benthic communities respond to a wide array of stressors in different ways, it is often possible to determine the type of stress that has affected a macroinvertebrate community.

Table 2. Biological indicator variables (with conceptual protocols) to be monitored in the Okanogan Baseline M&E Program and Chief Joseph Hatchery M&E Program.

General characteristics	Specific indicators	Recommended protocol	Sampling frequency	HGMP Performance Indicator
Adults	Escapement/Number	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Annual	--Total number of fish harvested in Colville Tribes summer/fall fisheries. --Annual number of summer/fall Chinook spawners in each spawning area, by age (Similkameen River, Okanogan River, Columbia River above Wells Dam). Etc.
	Age structure	Borgerson (1992)	Annual	To be completed as above
	Size	Anderson and Neumann (1996)	Annual	To be completed as above
	Sex ratio	Strange (1996)	Annual	To be completed as above
	Origin (hatchery or wild)	Borgerson (1992)	Annual	To be completed as above
	Genetics	WDFW Genetics Lab	Annual	To be completed as above
	Fecundity	Cailliet et al. (1986)	Annual	To be completed as above
Redds	Number	Mosey and Murphy (2002)	Annual	To be completed as above
	Distribution	Mosey and Murphy (2002)	Annual	To be completed as above
Parr/Juveniles	Abundance/Distribution	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Annual	To be completed as above
	Size	Anderson and Neumann (1996)	Annual	To be completed as above
Smolts	Number	Murdoch et al. (2000)	Annual	To be completed as above
	Size	Anderson and Neumann (1996)	Annual	To be completed as above
	Genetics	WDFW Genetics Lab	Annual	To be completed as above
Macroinvertebrates	Transport	Wipfli and Gregovich (2002)	Annual/Monthly	To be completed as above
	Composition	Peck et al. (2001)[1]	Annual	To be completed as above

Physical/Environmental Variables

The physical/environmental variables that will be measured in the Okanogan River basin (and some Upper Middle Mainstem below the hatchery site) can be grouped into seven general categories: water quality, habitat access, habitat quality, channel condition, riparian condition, flow/hydrology, and watershed condition. Each of these categories consists of one or more indicator variables. In sum, these categories and their associated indicators address watershed process and "input" variables (e.g., artificial physical barriers, road density, and other anthropogenic disturbances) as well as "outcome" variables (e.g., temperature, sediment, woody debris, pools, riparian habitat, etc.), as outlined in Hillman and Giorgi (2002) and the Action Agencies/NOAA Fisheries RME Plan.

Descriptions for methods of measure and protocols can be found in Attachment 2. Hillman, et. al. 2004 .*Monitoring Strategy for the Upper Columbia Basin [Appendix D]. Okanogan Baseline Program)*

Ecological Risk Assessment

In the case of supplementation, uncertainty surrounds both risks and benefits. Determining whether conditions are met for reducing risk are met is done through a risk-benefit assessment. Columbia River Basin data are not adequate for complete risk assessments, but limited data and expert opinion are available. Conducting risk assessments with limited data is uncomfortable but necessary to be as informed as possible about the conditions under which supplementation will take place.

In conditions of data paucity, qualitative risk assessments provide useful information for decision- making by presenting checklists for systematic assessments of potential risks before experimentation begins. The list does not comprise a risk assessment, but the information and the reasoning that go into the evaluation of items on the list do comprise a limited qualitative risk assessment that can form the basis for a risk management plan.

These ecological risks will be assessed using a *High, Medium, Low, Unknown and Indeterminate* ratings:

- Fitness differences between hatchery reared from wild
- Adequate proxies for fitness
- Out breeding depression
- Inbreeding depression
- Loss of within-population diversity
- Loss of genetic diversity between populations
- Artificial selection
- Competitive interaction between hatchery-reared and wild
- Long-term viability

- Disproportionate survival and straying
- Competition
- Incorporating surplus adult returns

The policy question is whether the potential benefits of a proposed action are large enough to outweigh the risks. From the policy perspective, an efficient action – one that makes the best use of public resources – is one that maximizes net benefit. Acceptable actions are those for which expected benefits are larger than the expected costs (Tietenberg 1988). This Conceptual M&E plan will rely upon a combination of studies to develop an approach to assess the relative risk and benefits for the hatchery.

These studies include:

1. An approach proposed by Waples and Drake (2002);
2. The Yakima Klickitat Fisheries Project;
3. Nez Perce Tribal Hatchery Benefit-Risk Analyses;
4. Johnson Creek Artificial Propagation and Enhancement Risk-Benefit Analysis;
5. Hood River Steelhead Hatchery Programs Risk/Benefit Analysis, and
6. Summer Chum Salmon Conservation Initiative--Hood Canal and Strait of Juan de Fuca Region.

PROGRAM GOALS

This Conceptual Plan (and the final M&E plan version) will:

1. Add significant value to the guidance provided in the HGMP's and the Master Plan.

2. Demonstrate a clear linkage to HGMP performance standards, related hatchery specific M&E activities and related Okanogan basin M&E activities.

3. Lead to better quantification and measurability of HGMP's and provide information and data sufficient to update or revise the HGMP's, M&E Plan and/or Master Plan.

4. Apply policy and technical guidance of NPCC, NOAA, and the ISAB as it applies specifically the Okanogan ecosystem and the integrated programs described in the HGMP's and other planning documents.

5. Provide measurable policy and technical answers about supplementation and the integrated production and recovery programs in the Okanogan basin.

6. Describe a comprehensive and rigorous program to collect, record, evaluate, and disseminate information on whether the program is producing a healthy and viable hatchery population.

7. Describe a comprehensive and rigorous program to collect, record, evaluate, and disseminate information on whether the program is making a sustainable contribution of adult returns to conservation and/or harvest.

8. Develop a comprehensive and rigorous program to collect, record, evaluate, and disseminate information to understand the potential effects on wild and native populations and the environment.

9. Monitor the effects of hatchery propagation on the long-term genetic fitness of fish stocks.

10. Monitor fish reared in hatcheries or by other artificial means for supplementing the recovery of a wild population to ensure that these supplementation actions clearly benefit that population.

11. Reduce or eliminate potential sources of confusion in an experiment by employing a means for minimizing their effects (See Hulbert 1984).

12. Closely coordinate the Hatchery Evaluation Program with the Okanogan Baseline Program to eliminate duplication of effort, share resources, and improve communication and collaboration with regional and Canadian entities.

GENERAL PROGRAM OBJECTIVES

General Program Objectives for Genetics, Harvest and Natural Production

- Collect, analyze and document genetic profiles
- Maintain diversity of the naturally spawning population
- Establish annual escapement goals for the spawning population
- Monitor and meet annual escapement goals for the spawning population
- Establish broodstock collection protocols
- Re-establish natural broodstock levels
- Re-establish natural distribution patterns

Habitat Inventory

- Augment Baseline Program habitat inventory[6] (tributary and mainstem) to characterize stream corridor structure.
- Intensify efforts to quantify habitat in the mainstem Okanogan by life stage.

[6] Baseline habitat inventories include the following: gradient, channel width, wetted width, substrate, LWD counts, canopy closure, pool/riffle ratio, pool/riffle area, water temperature and assorted water quality parameters. These data will be collected via the Okanogan Baseline Monitoring Program.

- Fill data gaps in tributary and mainstem (Okanogan and Col. R.) habitat inventory.
- Translate and refine existing habitat data into format compatible with EDT model.
- Estimate relative contribution of fine sediment deposition attributable to natural or anthropogenic sources.
- Estimate extent of thermal refugia, blocks, and sources of groundwater influence for the Okanogan River and its tributaries.
- Initiate remote sensing effort to determine condition and extent of riparian habitat in the Okanogan River and its tributaries.

Life History and Demographics

- Continue baseline life history and demographic monitoring[7].
- Refine estimates of basin-wide proportion of juvenile spring and summer/fall Chinook and steelhead rearing in the lower mainstem Okanogan River system.
- Develop methods to determine the spatial-temporal distribution of summer/fall Chinook and steelhead spawners.
- Determine whether multiple genetic stocks of summer/fall Chinook exist in the basin and, if so, determine their geographic distribution.
- Estimate degree of spatial-temporal overlaps between summer Chinook spawners and fall Chinook spawners.
- Develop a smolt counting facility on the lower Okanogan (the "Lower Okanogan Trap" or LOT) capable of estimating total smolt production by species with specified statistical power.
- Continue collaboration with Canadian and PUD programs for sockeye, steelhead and Chinook.

Passage Monitoring

- Access the planned basin-wide inventory of culverts with respect to fish passage.
- Conduct passage monitoring at applicable EMAP sites in Omak and Salmon Creeks and selected small tributaries and at Zosel dam.
- Coordinate with Canadian fisheries managers on passage issues at McIntyre dam, the mouth of Vaseux/McIntyre Creek, vertical drop structures, and other selected areas and tributaries.

[7] Baseline life history and demographic monitoring includes: redd counts and distribution (spring, summer and fall Chinook, steelhead and coho), juvenile passage at three sites, relative abundance and size distributions by species assessed at smolt traps, age and size distributions of adults, collection of DNA samples for future genetic analysis, estimating juvenile abundance in upper mainstem and selected tributaries. Some data will be collected via the Okanogan Baseline Monitoring Program, but it is yet undetermined if the scope is adequate for reporting out to the production program.

Facility Related; Chief Joseph Dam Hatchery Facility Evaluation

- Monitor compliance with guidelines, standards, and protocols.
- Discharge water quality at each propagation facility.
- Water withdrawals compared to WDFW adult passage criteria.
- Water withdrawals compared to NMFS juvenile screening criteria.
- Annual number of summer/fall Chinook aggregating or spawning immediately below water intake.
- Proportion of diversion of average monthly stream flow between intake and outlet for each hatchery facility.
- Annual certification of juvenile fish health.
- Periodic samples of natural-origin fish for disease occurrence.
- Annual number and locations of carcasses distributed for nutrient enrichment.
- Spatial and temporal spawning distribution above and below weir/trap compared to historical distribution.
- Annual mortality rates in each broodstock collection facility.
- Fish condition.
- Annual prespawning mortality rates of trapped fish in the hatchery or after release.
- Annual mortalities of non-target Chinook, sockeye, and steelhead affected by operation of broodstock collection facilities.
- Size at, and time of, release of hatchery-origin fish compared to size and timing of natural-origin Chinook and steelhead present.
- Number of fish in stomachs of sampled hatchery-origin fish in the Okanogan River, with estimate of natural-origin fish composition, and estimate of total consumption of natural-origin fish.

SPECIFIC PROGRAM OBJECTIVES

Sample Objectives and Preliminary Tasks—Conservation Standards, Performance Indicators, Tasks and Methods.

Objective 1. PROGRAM COORDINATION: *Plan for, administer, and coordinate Project activities.*

Methods: The CJD project was developed by the Colville Tribes and a growing number of partners such as WDFW, the Bureau of Reclamatin, BPA, NPCC and the Army Corps of Engineers. All Program activities require extensive coordination among comanagers. Coordination is and will continue to be accomplished through regularly scheduled meetings, frequent informal consultations, and document preparation, submittal and review. CJD Hatchery Steering Committee meetings in December and January are the primary forums for Project coordination and planning. The resulting Master Plan is the document serving as the primary descriptor of specific O&M and M&E methods, actions, procedures and delegation of responsibilities for the Program.

It is envisioned that a monthly Technical Oversight Team meetings will provide a regular opportunity for sharing information and problem solving among team members, project partners and state and federal co-managers. All Program activities are permitted under the ESA Section 10 process. Co-managers provide input to the required Annual Permit Report and any modifications that are needed. Annual planning documents prepared for funding review/approval by BPA include the project proposal, budget, and statement of work.

Co-managers also coordinate Program activities at meetings of Mid-Columbia Coordination Committee, Columbia Basin Fish and Wildlife Authority, HCP Hatchery Committee and others. Funding and Program oversight are being sought through BPA, with USFWS, NOAA, NPPC, and CBFWA also having major roles in Program development and implementation. On a local level, Program activities must be coordinated with landowners and consultants involved in planning and constructiing facilities.

The Okanogan River flows from Canada and Chinook salmon still migrate through Osoyoos Lake to spawn and rear in Canadian waters. The Okanogan Nation Alliance and the Colville Tribes have agreed to collaborate on recovery of fish and wildlife in the trans-boundary Okanogan subbasin, including the recovery of sockeye, Chinook, and steelhead. The Okanogan Nation Alliance is now working through Canada's Species At Risk Act (SARA), the equivalent of the Endangered Species Act, to seek a listing and recovery of Chinook salmon in the Canadian Okanogan River. This supplementation program may need to be expanded or altered to incorporate recovery initiatives for Chinook in Canadian waters. This could include additions in production, changes in release sites of existing production, or further refinement of harvest management guidelines to protect fish arising from Canadian waters. Coordination with Canadian recovery efforts will occur and program expansion, if appropriate, may occur to include any artificial production plans that arise from Canadian recovery efforts if they involve summer/fall Chinook.

Tasks:

Task 1.1.	Review and revise Program components as necessary with co-managers.
Task 1.2.	Participate in Annual Operations Plan meetings for Program, Mid-Columbia Coordinating Committee, and HCP Hatchery Committee.
Task 1.3.	Participate in monthly Technical Oversight Team meetings for Program.
Task 1.4.	Meet annual requirements for permits and authorizations to implement Project.
Task 1.5.	Develop and submit annual planning documents.
Task 1.6.	Plan with co-managers for management of Chinook and steelhead in response to ESA-listing and NOAA.
Task 1.7.	Coordinate with Canadian co-managers and tribes.

Objective 2. INTEGRATION WITH OKANOGAN RIVER BASELINE MONITORING AND EVALUATION PROGRAM (Baseline M&E): *Coordinate activities, share staff, resources, and data to ensure that the objectives of these two closely linked Monitoring and Evaluation Programs are achieved in the most comprehensive and cost effective manner.*

Methods: This hatchery evaluation plan is closely coordinated with the Okanogan Baseline Monitoring and Evaluation Plan (Baseline Plan) which will begin in 2004. Both plans will therefore combine to provide the necessary information for determining the success or failure of production programs in the Okanogan river basin. The Baseline Plan uses EPA's EMAP protocol and is further derived from the BPA-funded M&E Pilot Study developed for the Wenatchee subbasin (and subsequently adopted by all six subbasins in the Upper Columbia). The Okanogan Baseline Plan has been reviewed and strongly endorsed by the ISRP as "the model for the Columbia basin", and by the NPCC, is funded by BPA, and will be implemented by the Colville Tribes Fish and Wildlife Program staff and other regional experts.

Project staff, resources, and data will be shared between the two M&E efforts. If necessary, data collection protocols may be adjusted to fit the information needs of both efforts. Habitat assessment within the Okanogan Subbasin will be conducted under the Okanogan Baseline M&E. A corresponding assessment will be continued under the Hatchery M&E Plan in the Columbia River mainstem to encompass the entire area likely to be inhabited by summer/fall Chinook (Wells Dam to Chief Joseph Dam, possibly including Rufus Woods Lake).

Tasks:

Task 2.1.	Coordinate sharing of project staff, resources, and data between both M&E efforts.
Task 2.2.	Coordinate marking of natural-origin and hatchery-origin fish to meet the needs of both M&E efforts.
Task 2.3.	Coordinate all data collection procedures to meet the needs of both M&E efforts.

Objective 3. FISH MARKING: *Mark release groups of hatchery origin juvenile summer/fall Chinook and representative numbers of natural origin summer/fall Chinook in a manner sufficient to satisfy the information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries, spawning escapement, juvenile outmigration timing, and measure relative survival rates.*

Methods: To facilitate program evaluations, all hatchery-origin summer/fall Chinook will be adipose fin clipped and coded wire tagged using standardized methods. Unique tag codes will be used for each treatment group. In addition, a minimum of 800 hatchery-origin summer/fall Chinook from each treatment group will be PIT tagged to allow comparisons of outmigration timing and survival. Similarly, a minimum of 800 naturally produced juvenile summer/fall Chinook will be PIT tagged to allow comparisons to

hatchery treatment groups. PIT tagging will be conducted using standardized methods. Fish less than 60mm will not be PIT tagged.

An appropriate tagging program depends on a number of variables, including:

1. Smolt-to-adult survival rate.

2. Tag recovery rate.

3. Statistical design of the hatchery M&E program including the number of replicate test and control groups (HxH, HxW, WxW, acclimation vs. central facilities, acclimation 1 vs. acclimation 2, etc.) and the desired measurable differences between tests and controls.

4. How marked fish are used to calculate fishery contribution and exploitation rates.

Much of the above is, at this time, unknown for the Chief Joseph Dam Hatchery Program for summer/fall Chinook and spring Chinook. It is expected that tags from this program will be recovered from Columbia River fisheries and ocean fisheries through existing efforts. The Baseline M&E and Chief Joseph Hatchery M&E in combination will augment and increase existing cwt recovery efforts in the Okanogan River system and proximity. The broad, shallow Okanogan River should allow a relatively high recovery rate of tags from spawning ground surveys. The extensive, selective fisheries in the terminal fisheries (above Wells Dam) planned for these hatchery programs should, in combination with the other efforts already mentioned, lead to relatively high tag recovery rates. A final cwt tagging protocol will need to be developed if the hatchery is approved for construction and the conceptual M&E program, now under development, is refined into a final program.

At this conceptual stage of planning the following tagging protocol is proposed. This protocol assumes a moderate to high tag recovery rate and requires a relatively high rate of tagging. If implemented, this protocol would be modified based on actual fish survival rates and tag recovery rates from fisheries and spawning ground surveys.

Yearling smolts: 30% tagging, but not less than 100,000 tags per release group
Sub-yearling smolts: 50% tagging, but not less than 100,000 tags per release group

Spring Chinook

200,000 yearlings released at Ellisforde Pond -	100,000 tagged
50,000 yearlings released at St. Mary's Mission Pond -	50,000 tagged
50,000 yearlings released in Salmon Creek -	50,000 tagged
600,000 yearlings released at CJDH -	180,000 tagged
900,000 smolts	380,000-tagged (.42 tag rate)

Early-Arriving Summer/Fall Chinook

200,000 sub-yearlings at CJDH -	100,000 tagged	
300,000 yearlings at CJDH -	100,000 tagged	
400,000 yearlings at Riverside Pond -	120,000 tagged	

Later-Arriving Summer/Fall Chinook

300,000 sub-yearlings at Omak Pond -	150,000 tagged	
200,000 sub-yearlings at CJDH -	100,000 tagged	
400,000 yearlings at Omak Pond -	120,000 tagged	
200,000 yearlings at CJDH -	100,000 tagged	
2,000,000 smolts	790,000 tagged	40% tag rate

Tasks:

Task 3.1. Differently mark (fin clip) 100% of each summer/fall Chinook release group and coded wire tag approximately 40% as described in the "Methods" section above (30% yearling Chinook, 50% subyearling Chinook).

Task 3.2. PIT tag a minimum of 800 hatchery supplementation fish from each treatment group.

Task 3.3. PIT tag a minimum of 800 naturally produced parr from each treatment and control stream to estimate smolt production and survival (difficult or not possible in the Okanogan).

Objective 4. FACILITY OPERATION AND FISH HEALTH (covered under Central Facilities Plan):

Monitor artificial production facilities operation to ensure compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD.

Methods: Artificial production facilities will be operated in accordance with established fish health guidelines and facility operational standards and compliance will be monitored. Effluent from artificial production facilities, water withdrawal structures and in-stream water diversion structures will be inspected to verify that these are not detrimentally affecting natural populations (prevent access to natural spawning areas, affect spawning behavior of natural populations, impact juvenile rearing environment, etc.). Protocols will be developed for weir/trapping operations to minimize stress, injury, and/or mortality to natural populations. Fish will be examined by a professional pathologist in accordance with established fish health guidelines to verify that releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. This will include annual certification of juvenile fish health immediately prior to release, including pathogens present and their virulence, for each release site. Natural-origin fish will also be

periodically sampled at traps/weirs for disease occurrence. Distribution of carcasses or other products for nutrient enhancement will be accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines. The annual number and locations of carcasses distributed for nutrient enrichment will be documented and reported in accordance with applicable regulations and guidelines.

Spatial and temporal spawning distribution above and below weir/trap will be monitored through spawning surveys and compared to historical distribution to verify that adult brood stock collection does not significantly alter spatial and temporal distribution of any naturally produced population. A variety of methods may be used to evaluate weir effects on fish migration and behavior. One-mile segments below the weirs may be walked at least weekly during the trapping period, when flow conditions allow, determining if fish are "kegging up" below the weirs. We will periodically record behavior of fish approaching the weir using camcorders, to see if fish are jumping over the weir or turning back downstream after encountering the weir. We will observe and record condition and injuries of fish trapped to determine if anything related to the trap or weir was the cause, and correct it. We will visually examine the area about 100 feet upstream of the weir to see if fish are prevented from moving downstream. We will compare numbers of Chinook redds in segments above and below the weir during years when weir is operated to years when weir was not present. We may calculate and compare the population estimates of fish above the weir to the catch of fish at the weir to estimate weir efficiency.

Tasks:

Task 4.1.	Conduct periodic reviews and audits of facility operation.
Task 4.2.	Monitor facility operational guideline compliance.
Task 4.3.	Conduct annual discharge water quality sampling at each propagation facility to determine compliance with applicable water quality standards and guidelines in IHOT, PNFHPC, and the Co-Managers of Washington Fish Health Policy.
Task 4.4.	Conduct periodic inspections of water withdrawal systems to determine compliance with WDFW adult passage criteria and NOAA juvenile screening criteria.
Task 4.5.	Monitor annual mortality rates in each broodstock collection facility including prespawning mortality rates of trapped fish in the hatchery or after release, and mortalities of non-target Chinook, sockeye, and steelhead affected by operation of broodstock collection facilities.
Task 4.6.	Conduct periodic sampling (professional fish pathologist) of hatchery fish at each release site prior to release in accordance with established fish health guidelines.
Task 4.7.	Conduct periodic fish health sampling of natural origin fish at traps/weirs to determine level of pathogens in natural population.
Task 4.8.	Monitor and document annual number and locations of carcasses distributed for nutrient enrichment.

Task 4.9. Conduct spawning surveys to monitor spatial and temporal spawning distribution above and below weir/trap and compare to historical distribution.

Task 4.10. Document behavior and presence of Chinook and other species near the weirs and evaluate weir effects on fish behavior and migration.

Objective 5. HABITAT ASSESSMENT: *Conduct assessement of habitat condutions and environmental factors at acclimations sites and in the mainstem Columbia River outside of the Okanogan subbasin affecting migration or survival of summer/fall Chinook.*

Methods: Habitat assessment within the Okanogan Subbasin will be conducted under the Okanogan Baseline Program M&E (Baseline M&E). Areas not covered under the Baseline M&E but likely to be inhabited by summer/fall Chinook in the Columbia River mainstem (Wells to Chief Joseph Dam, possibly including Rufus Woods Lake) will be covered within a corresponding assessment continued under the Hatchery M&E Plan.

Similar to those habitat variables measured under the Baseline M&E Plan, the physical/environmental variables that will be measured in the mainstem Columbia River can be grouped into seven general categories: water quality, habitat access, habitat quality, channel condition, riparian condition, flow/hydrology, and watershed condition. Each of these categories consists of one or more indicator variables. In sum, these categories and their associated indicators address watershed process and "input" variables (e.g., artificial physical barriers, disturbance) as well as "outcome" variables (e.g., temperature, sediment, woody debris, pools, riparian habitat, etc.), as outlined in Hillman and Giorgi (2002) and the Action Agencies/NOAA Fisheries RME Plan.

Hillman (2004) contains descriptions of each physical/environmental indicator variables along with recommended methods for measuring each indicator, measurement protocols, and addresses sampling at different spatial scales. Most of the information presented in Hillman (2004) has also been summarized in Meehan (1991), MacDonald et al. (1991), Armantrout (1998), Bain and Stevenson (1999), OPSW (1999), Hillman and Giorgi (2002), and the Action Agencies/NOAA Fisheries RME Plan (2003).

Relative stream flows will be obtained from staff gauges and other existing sites installed at acclimation and adult collection facilities. Readings will be recorded daily from these gauges during the period when facilities are operating (October-May for acclimation facilities, August-November for adult collection facilities). Online streamflow data will be used when available. Recording thermisters (Onset) will be placed in the streams at the acclimation facilities near the water intakes, and in the middle of the streams within 100 feet of the weirs. Thermisters will be encased in short sections of PVC tubing and anchored in place with rebar or placed in laundry bags with rocks. Readings will be taken every hour during the period February-November. Movements of juveniles out of acclimation facilities and through the Okanogan River corridor will be estimated from PIT-tagged fish recorded by PIT tag readers located at the facility outlet structures and at

smolt traps. Movements of adult Chinook will be evaluated using daily catches at weirs/traps.

Tasks:

Task 5.1. Conduct habitat assessment in accordance with methods and protocols described in Hillman (2004).
Task 5.2. Compare streamflows to movement of juvenile Chinook at acclimation facilities and at smolt traps and adult Chinook at weirs/traps.
Task 5.3. Compare water temperatures to movement of juvenile Chinook at acclimation facilities and at smolt traps and adult Chinook at weirs/traps.

Objective 6. ACCLIMATED JUVENILE CHINOOK PERFORMANCE: *Evaluate acclimated juvenile Chinook salmon performance in terms of juvenile growth, survival, and migration, as these are critical indicators of the success of hatchery supplementation in rebuilding natural populations of Chinook salmon.*

Methods: Approximately 100 fish from each raceway will be randomly sampled before release and fork lengths and weights recorded. Length and weight data for migrating Chinook salmon smolts will also be collected in screw traps downstream of acclimation facilities. At least eight hundred fish from each captive brood treatment group and 800 conventional- origin juveniles will be PIT tagged. Date and time of release for volitional-release and forced-release fish will be obtained using PIT tag readers on outlet pipes. Data on arrival timing of PIT-tagged wild and hatchery-origin smolts will be obtained from the PTAGIS database for all recovery locations downstream.

Task 6.1. Compare mean length and weight of hatchery-origin smolts acclimated and released (e.g. volitional, forced release, captive, conventional F1) to wild smolts.
Task 6.2. Compare mean length and survival of (PIT-tagged) volitionally released smolts to all acclimated smolts.
Task 6.3. Compare arrival timing of different groups of PIT-tagged juveniles (e.g. volitional v. forced release, hatchery v. wild).
Task 6.4. Compare survival of different groups of PIT-tagged juveniles (e.g. volitional v. forced release, hatchery-origin v. wild).

Objective 7. NATURAL PRODUCTIVITY AND SPECIES INTERACTIONS: *Optimize natural production of Chinook salmon while managing adverse impacts from interactions between and within species and stocks. This objective includes maintaining Okanogan Chinook natural production and escapement at a level that would contribute an annual average of (XXX – to be determined through a combination of EDT analysis and recovery planning processes) adult fish to the Okanogan basin and consistently greater than (XXX- to be determined through a combination of EDT analysis and recovery planning processes)spawners per year.*

Methods: Local broodstocks of known natural component from the target population will be used for supplementation. We will monitor and evaluate natural production (presmolt, smolt, and adult numbers) and productivity (survival, life stage characteristics, pathogens, straying, and genetic composition) of supplemented populations and compare to baseline.

The effects of supplementation on parr and smolt numbers and spawning escapements of naturally produced salmon will be monitored and evaluated. Evaluation of natural productivity will be based upon changes in juvenile and spawner abundance. Releases of hatchery origin fish will be sufficiently marked (see Objective 3) to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.

Monitoring of spring Chinook in the Methow River will determine if any Okanogan summer/fall Chinook are present in the spawning spring Chinook population in sufficient numbers to cause concern. Coded-wire tags recovered from salmon carcasses will indicate any presence of hatchery-origin fish from the Okanogan subbasin.

The annual number of summer/fall Chinook spawners in each spawning area (by age); spawner-recruit ratios; annual number of redds in selected natural production index areas; and annual ratio of natural-origin and hatchery-origin summer/fall Chinook on spawning grounds will be monitored. This will be done to determine if the program contributes to an increasing number and distribution of spawners returning to the Okanogan, Similkameen, and Columbia Rivers. Evaluation of spawner abundance will also be conducted in coordination with the Baseline M&E and may include methods described in Crawford et al. (2002).

Monitoring of hatchery-origin juveniles outside the hatchery confines and of natural origin juveniles will be accomplished largely through the Baseline M&E as summarized in the tasks below. Data from this effort will include the annual number of marks and estimated total proportion of program's hatchery-origin fish in collections of juvenile summer/fall Chinook within the Okanogan basin and at any Columbia River dams.

Predation by artificially produced fish on naturally produced fish will be evaluated through analysis of stomach contents of hatchery-origin fish recaptured from the Okanogan River. Fish size and time of release of hatchery-origin fish will be compared to size and timing of natural-origin Chinook and steelhead present to further assess interaction/predation.

Tasks:

Task 7.1. Mark and release various life stages of Chinook salmon (see Objective 3). Determine fish numbers for each life stage based on existing natural production and natural rearing capacity estimates.

Task 7.2. Use existing weirs/traps to collect, mark (PIT tag, CWT), and enumerate emigrating fish and to identify and enumerate returning adults.

Task 7.3. Establish summer/fall Chinook redd count index areas (Columbia River above Wells Dam).

Task 7.4. Conduct summer/fall Chinook redd counts and carcass surveys in established index areas. Size (fork lengths), age (scales samples), and sex data will be collected during carcass surveys under this task.

Task 7.5. Compare natural production of supplemented populations to unsupplemented populations and baseline data.

Task 7.6. Monitor productivity of supplemented populations and compare baseline.

Task 7.7. Monitor changes in parr densities from snorkel and/or electrofishing surveys.

Task 7.8. Monitor changes in smolt abundance via trapping and mark recovery.

Task 7.9. Monitor changes in adult escapement through redd count and carcass surveys.

Task 7.10. Monitor straying of hatchery supplementation fish into adjacent and streams by weirs and carcass surveys.

Task 7.11. Determine spawner to recruitment relationship based on determined production and productivity indices (parr and smolt numbers, adult escapements, survival, eggs/spawner etc.).

Task 7.12. Predict population viability based on spawner to recruitment relationship to determine if the population will maintain itself through time in the absence of additional supplementation.

Task 7.13. Collect information regarding size at, and time of, release of hatchery-origin fish and compare to size and timing of natural-origin Chinook and steelhead present.

Task 7.14. Conduct stomach sampling of juvenile hatchery fish recaptured from the Okanogan River to determine predation rate on natural origin fish.

Task 7.15. Determine which supplementation strategies provide the quickest and highest response in natural production without adverse effects on productivity (Long Term).

Objective 8. LIFE HISTORY CHARACTERISTICS: *Monitor and evaluate life history characteristics of production fish to ensure that characteristics of the natural population are retained.*

Methods: Fish collected for broodstock will be taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken to ensure that the life history characteristics of the natural population do not change as a result of the artificial production program. Records will be maintained of the annual number of hatchery-origin juveniles released in natural rearing areas in the Okanogan basin, Columbia Cascade Province, and Columbia River basin by life-stage to ensure that release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.

Adult returns provide critical information needed to evaluate the success of hatchery supplementation in rebuilding natural populations of Chinook salmon. Life history data for wild and hatchery-origin adult Chinook will be obtained from fish trapped at weirs and collected on spawning ground surveys. Adults (F_1) conventional broodstock origin will have coded wire tags with unique tag codes to distinguish central facility, St. Mary's Mission Pond, Riverside, Tonasket, Ellisforde, and Similkameen origin. Wild fish will not be coded wire tagged and fin clipped.

Spawning ground survey data will be collected cooperatively through the baseline program. Data for individual fish encountered on these surveys include fork length, sex, percent spawned, scales, and marks. Population estimates of spawners above the weir are possible using the numbers of marked fish released above the broodstock collection weir(s) and the numbers of marked and unmarked fish recovered on spawning ground surveys. After data is collected from a fish, the tail will be cut off so duplicate data are not collected. Additional spawning ground surveys will be conducted to more closely approximate the total number of redds and spawners. Life history data for Chinook carcasses recovered on the spawning grounds can be compared to life history data from fish sampled at weirs to determine if spawning ground survey data are biased.

Tasks:

Task 8.1. Monitor number and annual temporal distribution of summer/fall Chinook broodstock and of natural-origin Chinook at point of collection.

Task 8.2. Collect age data to monitor annual age composition of broodstock collected and of natural-origin fish at the point of collection.

Task 8.3. Monitor through redd count and carcass surveys the annual number of hatchery-origin and natural-origin summer/fall Chinook spawning in the Columbia basin above the Methow River.

Task 8.4. Based upon weir and trap counts, estimate the annual number of natural-origin summer/fall Chinook migrating from the Okanogan basin.

Task 8.5. Compile information on specific life history characteristics of the hatchery-origin summer/fall Chinook annually. These include: juvenile dispersal timing from the Okanogan River (trap and weir counts); juvenile size and age composition at dispersal from the Okanogan River (trap and weir samples); adult return timing to Wells Dam (Wells Dam counts); adult return age, size, and sex composition in catch (catch data), broodstock, and on spawning grounds; adult fecundity and eggs size (from hatchery broodstock collection and spawning surveys).

Task 8.6. Compile information on specific life history characteristics of the natural-origin summer/fall Chinook annually. These include: juvenile rearing densities and distribution; juvenile dispersal timing from the Okanogan River; juvenile size and age composition at dispersal from the Okanogan River; adult return timing to Wells Dam; adult spawn timing including initiation, peak, and completion; spawning distribution; adult return age, size, and sex composition in catch, broodstock, and on spawning grounds;

adult fecundity and eggs size.

Task 8.7. Calculate juvenile carrying capacity of the Okanogan basin and Columbia River above Wells Dam to ensure that broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.

Task 8.8. Maintain records of the location of annual releases of hatchery-origin fish relative to natural rearing areas, timing of hatchery releases (volitional or forced) relative to emigration, densities, and estimated number of natural-origin summer/fall Chinook.

Task 8.9. Compare life history characteristics (run timing, length frequencies, sex ratios, age distributions, and smolt-to-adult ratios) of wild and marked (hatchery F_1) adult Chinook captured at weirs and on spawning ground surveys.

Task 8.10. Estimate abundance of wild and hatchery-origin adults above weirs.

Task 8.11. Determine through juvenile population surveys the residualism rates of hatchery-origin juveniles in natural habitat of the Okanogan basin and Columbia River above Wells Dam.

Objective 9. HARVEST: *Monitor and evaluate harvest of hatchery-origin fish to ensure that production and release strategies allow effective harvest while avoiding over-harvest of non-target species.*

Methods: Juvenile hatchery-origin summer/fall Chinook will be marked (coded wire tagged and fin clipped, Objective 3) to allow monitoring of the annual number of adults caught in all Columbia River and ocean fisheries. Non-target species (steelhead) will also be intercepted during these fisheries and information regarding steelhead catch and escapement will be collected and assessed. Annual catch, catch per unit of effort, total effort, escapement, and mark recovery information will be collected through cooperation with established information sources (e.g., WDFW, ODFW, PSMFC, etc.).

Tasks:

Task 9.1. Obtain mark recovery and sampling rate information for CJDHP hatchery-origin Chinook from established information sources (WDFW, ODFW, PSMFC, etc.) to determine total contribution to Columbia River fisheries (Zones 1-6 recreational, Zone 1-5 commercial, Zone 6 treaty, upper Columbia River recreational, Okanogan recreational) and combined ocean fisheries. Annual total effort estimates and catch per unit effort information for Upper Columbia and Okanogan River summer/fall Chinook recreational fisheries will also be obtained under this task.

Task 9.2. Monitor Colville Tribal C&S fisheries (Chief Joseph Dam Tailrace, and Okanogan River) to determine annual total effort, catch per unit of effort, and harvest of CJDHP hatchery-origin summer/fall Chinook.

Task 9.3. Obtain information from WDFW on annual number of steelhead caught and released during summer/fall Chinook recreational fisheries in the Okanogan River and upper Columbia River to assess incidental take of

non-target species.

Task 9.4. Monitor Colville Tribal C&S fisheries (Chief Joseph Dam Tailrace, and Okanogan River) to determine incidental catch of non-target species (steelhead).

Task 9.5. Obtain annual escapement estimates of Upper Columbia River Summer/Fall Chinook and Upper Columbia River Steelhead (hatchery-origin and natural-origin) in the ESU and in the Okanogan River from management agencies.

Objective 10. GENETICS: *Monitor and evaluate changes in genetic composition of target and adjacent populations following supplementation to manage genetic risks (extinction, loss of within- and between population variability, and domestication selection) to all stocks and to conserve and/or expand Okanogan stocks of Chinook salmon (identify and minimize artificial mixing of genetic stocks in the Okanogan and Methow basins).*

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Methods: Tissue samples will be collected from target and adjacent populations to establish baseline genetic composition and evaluate long-term changes to establish that patterns of genetic variation within and among natural populations do not change significantly because of artificial production. Tissues samples will be analyzed to evaluate genetic differences that may occur over time within mainstem Okanogan and mainstem Columbia River Chinook populations and for comparison with other Chinook populations in the Columbia River Basin and Upper Columbia region. Hatchery/acclimation site operations will be monitored to ensure that homing ability of hatchery origin fish is maximized, and straying, which may result in undesirable genetic mixing, minimized.

Tasks:

Task 10.1. Contract for genetic analysis of marked and unmarked fish.

Task 10.2. Collect tissue samples at the hatchery, weirs, traps, and from carcass surveys for genetic analysis.

Task 10.3. Monitor genetic indices from supplemented populations and compare baseline and controls.

Task 10.4. Develop genetic profile of Okanogan basin natural-origin summer/fall Chinook, as measured at program's outset (e.g. through DNA or allozyme procedures) to compare to genetic profiles developed in subsequent generations.

Task 10.5. Monitor annual number of natural-origin summer/fall Chinook at point of broodstock collection; escapement to spawning grounds compared to the minimum effective population size (when established) required for each spawning population; and timing of broodstock collection compared to overall run timing to ensure that collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Task 10.6. Determine and monitor the ratio of hatchery-origin to natural-origin fish passing Wells Dam (Wells Dam counts) and for each significant spawning area (spawning surveys, mark recovery) to ensure that hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population

Task 10.7. Monitor location of annual juvenile releases, annual length of acclimation for each release group and annual release procedure for each group (volitional, forced, or direct stream release) to ensure that homing ability to intended locations is maximized.

Task 10.8. Monitor through mark recovery the annual number of adult summer/fall Chinook returning to intended return location compared to number returning to unintended dams, fisheries, hatcheries, and natural production areas to determine rate of adult straying.

Task 10.9. Measure and monitor the annual level of smoltification at release for each release group and compare to a regional smoltification index (to be developed). This will be conducted to ensure that juveniles are released at fully smolted stage to maximize homing.

Task 10.10. Calculate moving geometric mean (based on number of ages at return for this ESU) of the annual number of adults available for broodstock to verify that the number of adults returning to the hatchery that exceeds broodstock needs is declining.

Objective 11. SOCIO-ECONOMIC EFFECTIVENESS: *Determine cost of program operation to verify that it does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population or does not exceed other available options to provide fish to satisfy tribal trust responsibilities.*

Methods: Total program and component costs will be determined and compared to monetary and non-monetary societal program benefits. Cost of feasible and available alternatives to provide similar or better tribal harvest for Colville Tribes and other tribes will also be evaluated. Juvenile production costs will be calculated and compared to other regional programs designed for similar objectives to verify program cost efficiency. Strategies will be developed to increase harvest opportunities for all fishers consistent with requirements of genetic, natural production, and experimentation objectives of this program. These will include development of selective and/or "status- index harvest" policies to increase opportunity for all fisheries in the Upper Columbia including the Okanogan basin).

Tasks:

Task 11.1. Calculate annual cost of program operations and compare to sum of ex-vessel value of commercial catches and monetary value of recreational fisheries targeting these summer/fall Chinook (based on proportion of summer/fall Chinook in harvest), and total Colville Tribes harvest and harvest by other tribes.

Task 11.2. Estimate cost of feasible and available alternatives to provide similar or

better tribal harvest for Colville Tribes and other tribes.

Task 11.3. Calculate annual juvenile production costs and compare to other regional programs designed for similar objectives.

Task 11.4. Monitor the number of summer/fall Chinook available for Colville Tribes ceremonial and subsistence use as an indicator of non-monetary program benefits.

Task 11.5. Monitor annual number of recreational angler days and length of seasons in fisheries targeting the program's summer/fall Chinook as an indicator of non-monetary program benefits.

Task 11.6. Monitor length and geographic extent of tribal fishing seasons targeting program's summer/fall Chinook as an indicator of non-monetary program benefits.

Task 11.7. Monitor number of tribes participating in harvest of program's summer/fall Chinook as an indicator of non-monetary program benefits.

Objective 12. LEGAL STANDARDS: *Operate program to be consistent with tribal trust responsibilities and treaty rights, mitigation agreements, and ESA responsibilities.*

Methods: This program will contribute to fulfilling tribal trust responsibilities and treaty rights, mitigation agreements, as well as addressing ESA responsibilities. Monitoring and evaluation will consist of tracking several indicators as defined in specific tasks below.

Tasks:

Task 12.1. Monitor total number of fish harvested in Colville Tribes summer/fall fisheries.

Task 12.2. Monitor total number of days open to tribal fisheries.

Task 12.3. Determine unmet demand for ceremonial and subsistence fish for Colville Tribal members.

Task 12.4. Determine total number of fish harvested in Zone 6 treaty fisheries.

Task 12.5. Performance requirements within each mitigation agreement (number of fish released, returning, or caught) will be measured and reported to parties of the agreement.

Task 12.6. Monitor program activities to ensure consistency with program HGMP.

Objective 13. RESEARCH: *Monitor program related research activities to ensure that such activities are conducted on an appropriate schedule, scale to address progress toward achieving the experimental objective, and evaluate beneficial and adverse effects of the supplementation program on natural populations.*

Methods: The ISAB in its 2000 report to NPCC cite a number of unanswered questions that persist around the topic of supplementation. Many of these questions are being

addressed in the Imnaha, Yakima, Deschutes, Tucannon and other river systems in the Columbia Basin. Most of these questions require formal and rigorous experimental design that requires immense infrastructure and major funding. This conceptual M&E plan will rely on the results from existing programs to answer the following questions.

1. Recent contributions of supplementation are largely unevaluated.

2. The reproductive performance of hatchery-origin adults spawning in the wild is largely unevaluated.

3. The reproductive performance of hatchery-origin adults spawning in the wild is largely unevaluated.

4. Ecological interactions are largely unevaluated.

5. Another source of uncertainty is interaction with other salmon restoration programs in the basin.

6. Risk-Benefit Assessments of Columbia River Basin Supplementation

Research related to artificial production program throughout the Columbia Basin will be reviewed to ensure that programmatic activities within the CJD Hatchery Program are: 1) consistent with the best available science, and 2) compliant with new and updated standards. Program staff from the CJD Hatchery Program will participate in annual symposia and program report sessions with staffs from other basin supplementation facilities to ensure that CJD Hatchery activities use standard scientific procedures including scientifically based experimental design with measurable objectives and hypotheses and are capable of evaluating various aspects of the artificial propagation program. Findings pertaining to program benefits and risks may be presented at AFS meetings, regional performance reviews, and when appropriate, in peer-reviewed scientific journals.

Tasks:

Task 13.1. Review all program activities to verify that a basic research framework exists and that current operations are utilizing new and updated standards.

Task 13.2. Participate in two annual basin production review conferences, meetings and/or symposia.

Task 13.3. Include findings from basin research into the CJD Hatchery Annual Report and M&E Report and Adaptive Management Plan.

Objective 14. DATA ANALYSIS, MANAGEMENT, AND REPORTING: *Complete data analysis and fulfill the data management and reporting requirements of the Hatchery M&E Plan.*

Methods: Several forms of analysis will be required as data are gathered for this project. Statistical tests, design components, database management architecture, and various reporting format requirements are things the sponsor will take into consideration.

A data management protocol will be established following the general outline:

1. **Develop Data Dictionary**
    - 1.1 Other Documentation
    - 1.1.1 Develop Data Flow Diagram
    - 1.1.2 Process Flow Diagram
    - 1.1.3 Prepare Data Management Plan (who, what when how)
2. **Develop Forms**
    - 2.1 Develop Field Forms
    - 2.1.1 Create list of useful existing forms
    - 2.1.3 Create Rough Drafts of needed Forms
    - 2.1.4 Edit Forms to coincide with Finalized Data Dictionary (when complete)
    - 2.1.5 Finalize Field Forms
    - 2.2 Develop PDA Forms
    - 2.3 Develop Data Loggers
3. **Establish Data Collection and Reporting Standards**
    - 3.1 Establish appropriate level of granularity
    - 3.2 Create/Adopt Chain of Custody Protocols
    - 3.3 Create/Adopt QA/QC Protocols
    - 3.4 Create/Adopt All Methods, Indicators, Metrics and Protocols (sampling and statistical design)
4. **Create/Adopt Field Manuals**
    - 4.1 Field Forms
    - 4.2 PDAs
    - 4.3 Data Loggers
    - 4.4 Test Field manuals and equipment
5. **Training of all field crews and outside contractors**
6. **Collect Data**
    - 6.1 Field Forms
    - 6.2 PDAs
    - 6.3 Data Loggers
7. **Data Reporting Timelines, Protocols and Formats**
8. **QA/QC**
9. **Data Transition**
    - 9.1 Develop data transition methods (including 10.0 Below)
    - 9.1.1 Field Forms to Electronic Entry Form
    - 9.2.1 Data Loggers to Individual PCs
    - 9.2.1.1 Individual PCs to Central Server
    - 9.3.1 PDAs to Individual PCs
    - 9.3.1.1 Individual PCs to Central Server
    - 9.4 Test data transitions
10. **All data to single repository**
    - 10.1 Develop Repository capability
    - 10.2 Test Repository capability
11. **Final Testing Check off**
12. **Documentation** From steps above to derive a program Data Management Protocol

Some additional considerations include:

- Complete subsequent EDT analysis for summer/fall Chinook: diagnosis of existing impediments to natural production and estimated benefits of alternative supplementation and habitat enhancement actions. Analyses require MS Access format and use of the Stream Reach Editor interface. Several forms of Beverton Holt calculations are used, among others, in the EDT method and modeling architecture.

- Determine what response variables can be measured, how to compare treatments, and how to estimate the variability in that response variable;

- Consider if strict adherence to statistical inference is necessary, and if not, then what evidence will be adequate for comparison of treatments;

- Consider whether other experimental designs are appropriate for this program.

All Hatchery M&E Plan data will be held within the data archive system developed for the Baseline M&E Plan. This system will consist of standardized Access/Excel database formats and will be compatible with other industry and BPA structures. Data will be unrestricted and available to all resource management agencies and subbasin planners. It will remain in this data archive system until delivered to BPA, the Upper Columbia RTT, CBFWA, and other basin database systems such as StreamNet, IBIS, and SSHIAP etc. The MIPT chair (Colville Tribal representative) will be responsible for oversight and QA/QC standards with day-day administration and maintenance. Hard copies of reports, field notes, and archive samples etc. will also be held under the direction of the MIPT.

A project web site will also be developed and maintained under the Baseline M&E Program. This website will allow CJDHP staff to enter and archive data elements in coordination with the UC Data Management protocols and database (NOAA fisheries). This site will be password protected, while providing an additional portal into publicly accessible sections. An FTP transfer protocol and secure site will also be developed for interim data access and transfer.

Annual Hatchery M&E Plan reports will be completed and submitted to BPA and other appropriate entities to fulfill all program-reporting requirements. Guidelines and recommendations will be developed addressing risks and benefits of supplementation (augmentation and restoration) in general and specific supplementation strategies (broodstock and release stage).

Tasks:

Task 14.1. Compile, analyze, and disseminate project information, data, and findings.
Task 14.2. Utilize and/or expand existing Okanogan Baseline M&E Program data archive system to accommodate Hatchery M&E Program needs.
Task 14.3. Utilize project web site.

Task 14.4. Report results annually to BPA, ISRP, NPCC, and co-managers.
Task 14.5. Report results annually to Upper Columbia Regional Technical Team and the UCSRB.
Task 14.6. Participate in annual M&E symposia and M&E coordination meetings in Upper Columbia.
Task 14.7. Participate in the Upper Columbia Monitoring and Evaluation Oversight Committee (RTT subcommittee).
Task 14.8. Publish reports in peer-reviewed journals as deemed beneficial to project or region.
Task 14.9. Develop long-term supplementation recommendations (Note: This objective may not be appropriate for this project or at this scale. Many supplementation programs are conducting these in-depth studies to provide the region with recommendations).

TIMELINE AND CONCEPTUAL WORK PLAN

Part I—Tasks to Expand the Conceptual Plan into a Final M&E Plan.

1. Finalize Conceptual Plan by to measure the effectiveness of the hatchery.
2. Identify all major and contributing data gaps.
3. Develop the sampling schedule and overall workplan.
4. Define the monitor protocols and study design for evaluating the contributions of hatchery and wild fish to harvest.
5. Finalize the monitoring protocols and study design for evaluating ecological interactions.
6. Finalize the monitoring protocols/study design for evaluating natural production to include evaluation of the effectiveness of these measures in providing or improving fish habitat.
7. Finalize the monitoring protocols/study design for evaluating survival estimates.
8. Incorporate stray rates for Okanogan and Methow summer/fall Chinook.
9. Establish timing, location, and tribal fishing effort, harvest and catch rates.
10. Identify differences in survival-at-release between acclimation locations.
11. Define the elements, costs, and protocols for tagging and marking program design.
12. Identify method and program to determine Jack (and Jill), or percocial rates.
13. Establish metric and method to measure and evaluate the contributions of supplementation-derived production to fisheries.
14. Compile and/or establish inter-dam loss rates by age/size class or stock.
15. Compile and/or establish downstream mortality rates by size class or time period.
16. Establish evaluation protocol to report on changes in ocean exploitation rates versus marine survival and their effect on the production program and/or fisheries.
17. Compile and/or establish distribution of hatchery returns (i.e., straying of hatchery releases versus homing fidelity of the natural fish).

18. Establish an accounting method for uncertainty in parameter estimates, including the assumption of fixed natural mortality rates between ages in the ocean (typically applies to Chinook assessments more than other species).

Part II—Tasks to finalize the Conceptual Plan as accomplished under the Okanogan Baseline Program, or in combination with subbasin and recovery planning.

1. Address all review comments to the conceptual plan.
2. Identify additional and common (Province and/or ESU wide) protocols, methods and management strategy for data.
3. Provide information, in summary form, on the full scope of fish and habitat assessment and restoration activities in the Okanogan subbasin.
4. Provide an estimate of the productive capacity (to determine if the subbasin is underseeded) in coordination with baseline, subbasin, and recovery planning assessments.
5. Access and incorporate terminal and extreme terminal fishery mortality/exploitation rates information into program M&E.
6. Access and incorporate ocean fishery mortalities/exploitation rates information into program M&E.
7. Access and incorporate natural mortality information into program M&E.

KEY PERSONNEL

Table 3. Key personnel. *To be completed in final M&E plan*

Name (alphabetically within agency)	**Title**	**Agency**	**FTE (mos.)**	**Expertise/Role**

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Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
Legal Standards:				
Programs contribute to fulfilling tribal trust responsibilities and treaty rights.	Total number of fish harvested in CCT summer/fall fisheries.	Broodstock collection, selective gear program. Tributary monitoring in Omak, Similkameen, Salmon Creek and small tributaries as per EMAP site selection. Creel survey by tribal F&W staff. This program will contribute to fulfilling tribal trust responsibilities and treaty rights, mitigation agreements, as well as addressing ESA responsibilities. Monitoring and evaluation will consist of tracking several indicators as defined in specific tasks defined under objective No. 12.	M&E specific activities in support of tribal Anadromous Fish Plan, Subbasin and Recovery Plans.	Wells dam counts, monitoring at Rocky Reach (settlement) and Rock Island. WDFW and tribal enforcement programs. Mid-Columbia HCP, FERC for Grant Co. PUD. Antione decision, Winters et., al. ESA and SARA Acts
	Total number of days open to tribal fisheries.	CCT F&W Department annual report, fishing seasons derived from run reconstruction, escapement estimates, dam counts and hatchery survival estimates.	none	PSC/PST (CRITFC and PFMC)
	Unmet demand for ceremonial and subsistence fish for CCT members	Hatchery return v. wild. Clockwork calculations in ESA listings for steelhead and spring Chinook	none	US v. Oregon, BiOp, US v. Washington and Idaho v. NMFS
	Total number of fish harvested in Zone 6 treaty fisheries	Covered in baseline program	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. PTAGIS	US v. Oregon, BiOp, US v. Washington and Idaho v. NMFS
Programs contribute to mitigation agreements, if any.	Performance requirements within each mitigation agreement (number of fish released, returning, or caught) are measured and reported to parties of the agreement.	Size and time at release, adult returns, smolt survival during migration, relative survival of hatchery and wild fish, and variability in brood stocks. Mid-Columbia HCP, BAMP, HGMP, BiOp and FERC monitored/modified as a result of CJD hatchery integrated program goals and objectives	none	HCP, BiOp, Mid-C settlement, Grand Coulee. Joint Fishery Parties and the mid-Columbia Coordinating Committee
Programs address ESA responsibilities	This HGMP is current and sufficient under ESA Section 4(d) or Section 7.	This program will be used to validate the assumptions and hypotheses in the HGMP. Specific activities will include juvenile and adult monitoring at up to 35 sites. Productivity and capacity will be evaluated at up to 35 sites using EMAP protocols as outlined in the Okanogan Baseline program. A combination of this Hatchery M&E and the Okanogan Baseline	Subbasin Plans, Recovery Plans (State, tribal and federal). BiOp check-ins in 2003, 2008 and 2013. Results from BPA Pilot M&E studies in UC (Methow, Entiat, Wenatchee, Okanogan).	Existing and future Biological Opinions, Section 7 and 6 permits. PNAMP and CSMEP processes to improve coordination, reporting standards, peer-review etc.
Harvest Standards:				
Hatchery-origin fish are produced and released in a manner enabling effective harvest while avoiding over-harvest of non-target species.	Annual number of program's hatchery-origin summer/fall Chinook caught in all Columbia River fisheries (Zones 1-6 recreational, Zone 1-5 commercial, Zone 6 treaty, upper Columbia River recreational, Okanogan recreational, CCT Chief Joseph Dam Tailrace, and CCT Okanogan River).	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats. Also see Non Target Taxa of Concern sections. : Juvenile hatchery-origin summer/fall Chinook will be marked (coded wire tagged and fin clipped, Objective 3) to allow monitoring of the annual number of adults caught in all Columbia River and ocean fisheries. Non-target species (steelhead) will also be intercepted during these fisheries and information regarding steelhead catch and escapement will be collected and assessed. Annual catch, catch per unit of effort, total effort, escapement, and mark recovery information will be collected through cooperation with established information sources (e.g., WDFW, ODFW, PSMFC, etc.).	Monitoring of PFMC, US/Canada, PST and North of Falcon processes.	Changes to PST US/Canada agreements 2009-2011), BiOp. US v. Oregon, BiOp, US v. Washington and Idaho v. NMFS

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Annual number of steelhead caught and released during summer/fall Chinook fisheries in the Columbia Cascade Province (CCT Chief Joseph Dam Tailrace, CCT Okanogan River, Okanogan recreational, upper Columbia River recreational)	CCT and WDFW Creel surveys to be jointly developed and implemented via hatchery program specifics and goals. Broodstock collection.Size and time at release, adult returns, smolt survival during migration, relative survival of hatchery and wild fish, and variability in brood stocks. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats.	Selective gear studies. Zosel dam feasibility study. Possible future video interrogation at Zosel. Adult PIT tag and telemetry.	CWT and Catch Reporting to WDFW. Annual reports from WDFW (lag time is a year or more).
	Annual escapement of Upper Columbia River Steelhead (hatchery-origin and natural-origin) in the ESU and in the Okanogan River.	Expanded spawning counts in mainstem Columbia river habitats below and adjacent to CJD. Adult PIT tag and telemetry. Utilize age composition data, adult escapement estimates, and creel data to calculate smolt-to-adult survival rates on hatchery Chinook.	“Spawning escapement” could be estimated as the number of redds times a “fish-per-redd” estimate. WSRFB (2003) uses 2.2 Chinook per redd, assuming one redd per female. For steelhead, they assume 1.23 redds per female. A more accurate method currently used by WDFW in the Upper Columbia Basin is based on the sex ratio of broodstock (not	FPC counts, PTAGIS (also monitored as part of baseline program). US v. Oregon, BiOp, US v. Washington and Idaho v. NMFS
	Annual escapement of Upper Columbia River Summer/Fall Chinook (hatchery-origin and natural origin) in the ESU and in the Okanogan River.	Expanded spawning counts in mainstem Columbia river habitats below and adjacent to CJD. Adult PIT tag and telemetry.	See "ongoing monitoring programs in the Okanogan" attachment. Redd and carcass counts. Broodstock collection and selective harvest program	USFS and USFWS fish surveys. CRITFC, State of Alaska monitoring
	Catch per unit effort in each Columbia Cascade Province fishery (CCT Chief Joseph Dam Tailrace, CCT Okanogan River, Okanogan recreational, upper Columbia River recreational)	CCT and WDFW Creel surveys to be jointly developed and implemented via hatchery program specifics and goals. Broodstock collection.	none	CWT and Catch Reporting to WDFW. Annual reports from WDFW (lag time is a year or more).
	Total effort in each Columbia Cascade Province fishery (CCT Chief Joseph Dam Tailrace, CCT Okanogan River, Okanogan recreational, upper Columbia River recreational)	CCT and WDFW Creel surveys to be jointly developed and implemented via hatchery program specifics and goals. Broodstock collection.	none	CWT and Catch Reporting to WDFW. Annual reports from WDFW (lag time is a year or more).

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Marking rate (100%) by mark type for each summer/fall Chinook release group (Similkameen Pond, Bonaparte Pond, Tonasket Pond, Omak Pond, Chief Joseph Dam Hatchery).	PIT tag a minimum of 800 hatchery supplementation and general production fish released in or nearby study streams. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station. b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site. c. Maintain daily records of trap operation and maintenance, number and condition of fish trapped d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible. e. Provide recommendations on means to improve broodstock	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. PTAGIS. 2-3 permanent juvenile sites planned using incline and screw traps, permanent weirs in Omak and Salmon Creeks)	Permitting and PTAGIS coordination
	Sampling rate by mark type for each Columbia River fishery (Zones 1-6 recreational, Zone 1-5 commercial, Zone 6 treaty, upper Columbia River recreational, Okanogan recreational, CCT Chief Joseph Dam Tailrace, and CCT Okanogan River).	Augment monitoring of PFMC, US/Canada, PST and North of Falcon processes and PTAGIS with juvenile trap sampling, PIT tag and telemetry	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. PTAGIS. 2-3 permanent juvenile sites planned using incline and screw traps, permanent weirs in Omak and Salmon Creeks)	FPC counts, PTAGIS (also monitored as part of baseline program).
	Number of marks from these summer/fall Chinook programs observed in fishery samples and estimated total contribution of this population to Columbia River fisheries (Zones 1-6 recreational, Zone 1-5 commercial, Zone 6 treaty, upper Columbia River recreational, Okanogan recreational, CCT Chief Joseph Dam Tailrace, and CCT Okanogan River) and combined ocean fisheries. .	To facilitate program evaluations, all hatchery-origin sur	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. PTAGIS. 2-3 permanent juvenile sites planned using incline and screw traps, permanent weirs in Omak and Salmon Creeks)	FPC counts, PTAGIS (also monitored as part of baseline program).
Conservation Standards:				

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
Programs contribute to an increasing number and distribution of spawners returning to the Okanogan, Similkameen, and Columbia Rivers.	Annual number of summer/fall Chinook spawners in each spawning area, by age (Similkameen River, Okanogan River, Columbia River above Wells Dam).	Determine the pre-spawning and green egg to released fry survivals for each program at various life stages. a. Monitor growth and feed conversion for Chinook fry. b. Determine green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for Chinook. c. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for Chinook broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for fed fry. d. Summarize results of tasks for presentation in annual reports. e. Identify where the supplementation program is falling short of objectives, and	Both status/trend and effectiveness monitoring require landscape classification. The purpose of classification is to describe the "setting" in which monitoring occurs. This is necessary because biological and physical/environmental indicators may respond differently to tributary actions depending on landscape characteristics.	HCP, BiOp, Mid-C settlement, Grand Coulee
	Spawner-recruit ratios.	SAR and run reconstruction, AUC calculations. Size and time at release, adult returns, smolt survival during migration, relative survival of hatchery and wild fish, and variability in brood stocks	none	BiOp and HCP monitoring
	Annual number of redds in selected natural production index areas.	Augment monitoring of redds in mainstem areas adjacent and downstream to the CJD and CJD hatchery facilities. Abundance of redds will be reported as the number of redds within a population or subpopulation. Abundance will also be reported as the number of redds per km within each population or subpopulation.	In addition to ongoing annual carcass counts and aerial survey, CCT will assess changes in spawning distribution by implementing a five-year rotating panel design with up to 35 reaches per year monitored. In order to estimate precision, 10% of the sites within each of the five zones will be sampled by two independent crews each year for five years. This means that each year, five randomly selected sites within each zone will be surveyed by two different crews. Sampling by the two independent crews will be no more than two-days apart. This will minimize the effects of site changes on estimates of precision. These sites will also be used to compare protocols (e.g., comparison of the	USFS and USFWS?

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Annual ratio of natural-origin and hatchery-origin summer/fall Chinook on spawning grounds.	Carcass surveys combined with creel and adult PIT tag returns. Smolt-to-adult survivals will be documented as part of the integrated baseline and hatchery M&E.	Carcass surveys in ongoing index areas. Broodstock collection and selective harvest program.	Creel surveys.
Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Juvenile Condition Factor	Broodstock collection, spring Chinook harvest selective gear program. Tributary monitoring in Omak, Similkameen, Salmon Creek and small tributaries as per EMAP site selection.	The baseline plan includes Fulton-type condition as the metric for well-being of juvenile fish. Juvenile fish collected during electro fishing and with rotary traps (or other appropriate traps) will be measured (fork length for salmonids and total length for all other fish; mm) and	IHOT and other APRE defined activities
	Annual marking rates by mark type for each summer/fall Chinook release group (see above).	Statistical Power, variability, effect size, significance level will be defined in final M&E plan and based upon detection goals.		PSC/PST (CRITFC and State of AK)
	Annual number of marks and estimated total proportion of program's hatchery-origin fish in collections of juvenile summer/fall Chinook within the Okanogan basin and at any Columbia River dams.	Add to existing programs by estimating additional numbers in mainstem areas adjacent to and downstream of CJD and CJD hatchery facilities. Utilize age composition data, adult escapement estimates, and creel data to calculate smolt-to-adult survival rates on hatchery Chinook.	The plan includes the abundance and distribution of juvenile fish as an indicator of population health. Juvenile numbers will be estimated with snorkeling and electro fishing within status/trend monitoring reaches and effectiveness monitoring sites. Abundance of smolts is an estimate of the total number of smolts produced within a watershed or basin.	PSC/PST (CRITFC and State of AK)
	Annual proportion of hatchery-origin summer/fall Chinook on the spawning grounds.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats.	as above	PSC/PST (CRITFC and State of AK). Joint Fishery Parties and the mid-Columbia Coordinating Committee
Life-History Characteristics:				

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Annual temporal distribution of summer/fall Chinook broodstock collection and of natural-origin Chinook at point of collection.	Fish will be collected at the hatchery weir and at the mouth of the Okanogan River across the spawning run. Specific sex ratios and number of HvW fish will be established based upon broodstock collection protocol as per YKFP model (MIPT 1997), and/or HGMP. Modifications to Wells program and possibly Eastbank and Turtle Rock. Fish collected for broodstock will be taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken to ensure that the life history characteristics of the natural population do not change as a result of the artificial production program. Records will be maintained of the annual number of hatchery-origin juveniles released in natural rearing areas in the Okanogan basin, Columbia Cascade Province, and Columbia River basin by life-stage to ensure that release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration	Video interrogatiion at up to 5 sites is planned. PIT tag detection feasibility underway for these sites as well.	. Joint Fishery Parties and the mid-Columbia Coordinating Committee
	Annual age composition of broodstock collected and of natural-origin fish at the point of collection.	Scale, otolith collections. Age-at-length calculations in absence. Phenotypic and genotypic characteristics of salmon stocks will be recorded.	noneVideo interrogatiion at up to 5 sites is planned. PIT tag detection feasibility underway for these sites as well.	PSC/PST (CRITFC and State of AK). Joint Fishery Parties and the mid-Columbia Coordinating Committee
Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Annual number of natural-origin summer/fall Chinook removed for broodstock.	Adults will be collected for broodstock at weirs at the hatchery central facility and other temporary or permanent facilities in the mainstem Okanogan river and/or selected tributaries, transported to the central facility and held until spawning in August or September. Progeny will be reared at the central facility, acclimated at facilities in the mainstem Okanogan and tributaries and released. All progeny will be marked with adipose fin clips and coded wire tags; a portion will also be marked with PIT tags.Broodstock collection protocol as per YKFP model (MIPT 1997), and/or HGMP. Broodstock mining protocol as per Lichatowich and YFP NEPA documentation.Modfications to Wells program and possibly Eastbank and Turtle Rock	Video interrogatiion at up to 5 sites is planned. PIT tag detection feasibility underway for these sites as well.	PSC/PST (CRITFC and State of AK). Use WDFW catch record card estimates and samples of adult CWT codes collected during creel surveys and redd counts to estimate the return and sport harvest of all groups of released Okanogan and mainstem UC origin Chinook within the CJD central facility and Okanogna River areas of Washington.
	Annual number of hatchery-origin and natural-origin summer/fall Chinook spawning in the Columbia basin above the Methow River (see above).	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Facilities constructed under this project will specifically address juvenile production and acclimation/release needs that are essential to achieving the overall Okanogan Basin natural and hatchery production goals.	In addition to ongoing annual carcass counts and aerial survey, CCT will assess changes in spawning distribution by implementing a five-year rotating panel design with x	PSC/PST (CRITFC and State of AK)
	Annual number of hatchery-origin juveniles released in natural rearing areas.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats.	The plan includes the abundance and distribution of juvenile fish as an indicator of population health. Juvenile numbers will be estimated with snorkeling and electro fishing within status/trend monitoring reaches and effectiveness monitoring sites. Abundance of smolts is an estimate of the total number of smolts produced within a watershed or basin	PSC/PST (CRITFC and State of AK)

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Annual estimates of the number of natural-origin summer/fall Chinook migrating from the Okanogan basin.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. We wish to test if juvenile salmon abundance in terms of numbers per square meter has increased significantly post impact. The annual variation in numbers is significant as can be seen in Table 8 taken from Bisson et. al. (in press).The number of juveniles per square meter has been shown to be more descriptive than using either linear measures (#/m) or volume measures (#/m3). The data will be tested using a paired t-test, testing whether there is a change of greater than 20% in the calculated difference in the abundance estimate for the impact column and the control column for the sampled projects. This test will be conducted in Years 1, 2, and 5.	The plan includes the abundance and distribution of juvenile fish as an indicator of population health. Juvenile numbers will be estimated with snorkeling and electro fishing within status/trend monitoring reaches and effectiveness monitoring sites. Abundance of smolts is an estimate of the total number of smolts produced within a watershed or basin. Investigators will use floating screw traps (or other appropriate traps depending on stream conditions) to collect downstream migrating smolts. time of the change in abundance of rearing juvenile salmonids	PSC/PST (CRITFC and State of AK)
Life history characteristics of the natural population do not change as a result of the artificial production program.	Specific life history characteristics of the hatchery-origin summer/fall Chinook are measured annually: juvenile dispersal timing from the Okanogan River; juvenile size and age composition at dispersal from the Okanogan River; adult return timing to Wells Dam; adult return age, size, and sex composition in catch, broodstock, and on spawning grounds; adult fecundity and eggs size.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Broodstock collections program will query for condition factors age, size, sex, fecundity, egg viability and size. Size and time at release, adult returns, smolt survival during migration, relative survival of hatchery and wild fish, and variability in brood stocks	Biological and Physical indicators and variables as per the UC Monitoring Strategy adapted to the Okanogan river basin. EMAP rotating panel design. Up to 50 sites will be monitored using tessellated random sampling design. Estimates of productivity, abundance and diversity from EDT and other cross validation analyses as applicable.	PSC/PST (CRITFC and State of AK)

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Specific life history characteristics of the natural-origin summer/fall Chinook are measured annually: juvenile rearing densities and distribution; juvenile dispersal timing from the Okanogan River; juvenile size and age composition at dispersal from the Okanogan River; adult return timing to Wells Dam; adult spawn timing including initiation, peak, and completion; spawning distribution; adult return age, size, and sex composition in catch, broodstock, and on spawning grounds; adult fecundity and eggs size.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Broodstock collections program will query for condition factors age, size, sex, fecundity, egg viability and size	Biological and Physical indicators and variables as per the UC Monitoring Strategy adapted to the Okangan river basin. EMAP rotating panel design. Up to 50 sites will be monitored using tesellated random sampling design. Estimates of productivity, aduncance and diversity from EDT and other cross validation analyses as applicable. Monitoring of PFMC, US/Canada, PST and North of Falcon processes. PTAGIS. 2-3 permanent juvenile sites planned using incline and screw traps, permanent weirs in Omak and Salmon Creeks). time of the change in abundance of rearing juvenile salmonids produced in the stream reach examined. Instead of a randomly selected stream reach, the stream reach impacted by the project is sampled. These “impact” areas have been matched with “control” areas of the same length and size on the same stream whenever possible in order to produce a Before After Control Impact (BACI) experimental design.	
Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.	Juvenile carrying capacity of the Okanogan basin and Columbia River above Wells Dam, including method of calculation.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Index sites will be selected for these areas and program will utilize methods and protocols as defined in the Baseline program. Estimates of productivity, abundance and diversity from EDT and other cross validation analyses as applicable. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic	Biological and Physical indicators and variables as per the UC Monitoring Strategy adapted to the Okanogan river basin. EMAP rotating panel design. Up to 50 sites will be monitored using tessellated random sampling design.	USFS and USFWS habitat surveys (Hankin Reeves, but begin modified to match UC Strategy and Okanogan Plan in 2004-2006)

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Annual release of hatchery-origin summer/fall Chinook in the Okanogan basin, Columbia Cascade Province, and Columbia River basin by life-stage.	All acclimation and facilities releases (volitional, forced and/or conditional) will be monitored via PIT detection, hand counts and standard estimates used at hatchery facilities. Automated data collection, QA/QC will be built into the PIT system. Hydroacoustic and/or other passive means of outfall migration may be used. Releases from all other facilities will be monitored via the PTAGIS system and Mid-Columbia Coordinating committee : Approximately 100 fish from each raceway will be randomly sampled before release and fork lengths and weights recorded. Length and weight data for migrating Chinook salmon smolts will also be collected in screw traps downstream of acclimation facilities. At least eight hundred fish from each captive brood treatment group and 800 conventional- origin juveniles will be PIT tagged. Date and time of release for volitional-release and forced-release fish will be obtained using PIT tag readers on outlet pipes. Data on arrival timing of PIT-tagged wild and hatchery-origin smolts will be obtained from the PTAGIS database for all recovery loca	none	Mid-C, PST, PSC. HCP Hatchery Committee. Joint Fishery Parties and the mid-Columbia Coordinating Committee
	Residualism rates of hatchery-origin juveniles in natural habitat of the Okanogan basin and Columbia River above Wells Dam.	Approximately 100 fish from each raceway will be randomly sampled before release and fork lengths and weights recorded. Length and weight data for migrating Chinook salmon smolts will also be collected in screw traps downstream of acclimation facilities. At least eight hundred fish from each captive brood treatment group and 800 conventional- origin juveniles will be PIT tagged. Date and time of release for volitional-release and forced-release fish will be obtained using PIT tag readers on outlet pipes. Data on arrival timing of PIT-tagged wild and hatchery-origin smolts will be obtained from the PTAGIS database for all recovery locations downstream. Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats.	"Spawning escapement" will be monitored for percocial rates and annual snorkeling and electroshocking will monitor for residual Chinook. Monitoring the status and trends of recovery units, Evolutionarily Significant Units (ESUs), populations, subpopulations, and habitat characteristics is an important component of the Action Agencies/NOAA Fisheries RME Plan, which will be implemented within the Okanogan Basin. The RME Plan calls for the implementation of the U.S. Environmental Protection	HCP, BiOp, Mid-C settlement, Grand Coulee
	Location of annual releases of hatchery-origin fish relative to natural rearing areas.	Releases from all acclimation facilities will be monitored annually throughout the juvenile outmigratoin period. Baseline incline and screw traps along with two-three permanent weirs and a counting facility at Zosel dam will be used to in combination with coordination of USFWS and WDFW releases to differentiate production areas. All hatchery fish will be uniquely marked.	Five permanent sites will be monitored for outmigration. Coordination with USFWS and WDFW on hatchery releases, timing and location are part of the baseline program.	HCP, BiOp, Mid-C settlement, Grand Coulee
	Timing of hatchery releases (volitional or forced) relative to emigration, densities, and estimated number of natural-origin summer/fall Chinook.	All acclimation and facilities releases (volitional, forced and/or conditional) will be monitored via PIT detection, hand counts and standard estimates used at hatchery facilities. Automated data collection, QA/QC will be built into the PIT system. Hydroacoustic and/or other passive means of outfall migration may be used. Releases from all other facilities will be monitored via the PTAGIS system and Mid-Columbia Coordinating committee	Five permanent sites will be monitored for outmigration. Coordination with USFWS and WDFW on hatchery releases, timing and location are part of the baseline program.	HCP, BiOp, Mid-C settlement, Grand Coulee

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Residualism rates of hatchery-origin juveniles in natural habitat of the Okanogan basin and Columbia River above Wells Dam.	Stratified Radio Telemetry, downstream trapping. : Local broodstocks of known natural component from the target population will be used for supplementation. We will monitor and evaluate natural production (presmolt, smolt, and adult numbers) and productivity (survival, life stage characteristics, pathogens, straying, and genetic composition) of supplemented populations and compare to baseline. The effects of supplementation on parr and smolt numbers and spawning escapements of naturally produced salmon will be monitored and evaluated. Evaluation of natural productivity will be based upon changes in juvenile and spawner abundance. Releases of hatchery origin fish will be sufficiently marked (see Objective 3) to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural	Juvenile monitoring and telemetry in coordination with five permanent sites monitored for outmigration. Coordination with USFWS and WDFW on hatchery releases, timing and location are part of the baseline program.	PUD HCP monitoring
Genetic Characteristics:				
Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Genetic profile of Okanogan basin natural-origin summer/fall Chinook, as measured at program's outset (e.g. through DNA or allozyme procedures) is compared to genetic profiles developed in subsequent generations.	Focus will be to detect metric supporting analysis of: outbreeding depression, inbreeding depression, loss of within-population diversity, loss of genetic diversity between populations, artificial selection, competition interactions, long-term viability and disproportionate survival. Collect non lethal sample from a statistically significant number of adults at broodstock and selective gear fishery sites. Collect non lethal tissue samples from each hatchery release group. Tissue samples will be collected from target and adjacent populations to establish baseline genetic composition and evaluate long-term changes to establish that patterns of genetic variation within and among natural populations do not change significantly because of artificial production. Tissues samples will be analyzed to evaluate genetic differences that may occur over time within mainstem Okanogan and mainstem Columbia River Chinook populations and for comparison with other Chinook populations in the Columbia River Basin and Upper Columbia region. Hatchery/acclimation site operations will be	dNA archive from adult returns, analyses in 2005, 06 and beyond.	HCP, BiOp, Mid-C settlement, Grand Coulee
Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.	Annual number of natural-origin summer/fall Chinook at point of broodstock collection.	Collect information from all broodstock collection program and selective harvest sites consistent with provisions of Section 10(a)(1)(A) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531-1543), the National Marine Fisheries Service (NOAA Fisheries) regulations governing ESA-listed species permits (50 CFR Parts 222-226).	Selective harvest program.	Wells dam counts, monitoring at Rocky Reach (settlement) and Rock Island. WDFW and tribal enforcement programs. Mid-Columbia HCP, FERC for Grant Co. PUD. Antione decision, Winters et., al. ESA and SARA Acts
	Annual escapement to spawning grounds compared to the minimum effective population size (when established) required for each spawning population.	Use of VSP and goals outlined in NOAA and State Recovery Plans in comparison to data collected from baseline program. Comparison to hatchery and integrated recovery goals and objective.	Baseline will collect all applicable data for estimating productivity. Estimates from EDT and other cross validation studies. Tribal anadromous fish plan, Recovery Plan, HCP, BiOp and ESA recovery plan will be used to establish goals and	ESA, Recovery Plans, BiOp, Subbasin and tribal anadromous fish plan.

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Timing of broodstock collection compared to overall run timing.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. At these areas document sex ratio, number, timing and condition of fish.	In addition to ongoing annual carcass counts and aerial survey, CCT will assess changes in spawning distribution by implementing a five-year rotating panel design with x	
Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population	Ratio of hatchery-origin to natural-origin fish for each significant spawning area.	Covered in baseline program, except those mainstem area below and adjacent to CJD and the hatchery facilities site. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats. Collect information from all broodstock collection program and selective harvest sites consistent with provisions of Section 10(a)(1)(A) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531-1543), the National Marine Fisheries Service (NOAA Fisheries) regulations governing ESA-listed species permits (50 CFR Parts	In addition to ongoing annual carcass counts and aerial survey, CCT will assess changes in spawning distribution by implementing a five-year rotating panel design with x reaches per year monitored.	PSC/PST (CRITFC and State of AK). Use WDFW catch record card estimates and samples of adult CWT codes collected during creel surveys and redd counts to estimate the return and sport harvest of all groups of released Okanogan and mainstem UC origin Chinook within the CJD central facility and
	Observed and estimated numbers of hatchery-origin and natural-origin summer/fall Chinook passing Wells Dam.	Dam counts will be conducted at Wells Dam in coordination with WDFW and Chelan Co. PUD. These data will be compared to other dam passage numbers at Rock Island and Rocky Reach etc. and integrated into program release numbers, PIT tags, and telemetry data specific to the CJD hatchery program	none	
Juveniles are released on-station or after sufficient acclimation to maximize homing ability to intended return locations.	Location of annual juvenile releases.	Location of acclimation sites will be based upon results from feasibility studies conducted for each site. Sites will be selected from the following criteria: 1. located in area with sufficient water quality and quantity to support juveniles. 2. located in area where sufficient hiding cover and food resources are located. 3. located adjacent or within areas historical inhabited by summer/fall Chinook. Releases from all other facilities will be monitored via the PTAGIS system and Mid-Columbia Coordinating committee	none, except to coordinate marking programs.	PSC/PST (CRITFC and State of AK). Use WDFW catch record card estimates and samples of adult CWT codes collected during creel surveys and redd counts to estimate the return and sport harvest of all groups of released Okanogan and mainstem UC origin Chinook within the CJD central facility and Okanogna River areas of Washington.
	Annual length of acclimation for each release group.	Monitored as per YKFP protocols for smoltification. Growth rate, length, FPP, cortosol levels etc. will all be monitored for each release group to establish timing for each acclimation site.	none	
	Annual release procedure for each group – volitional, forced, or direct stream release.	In HGMP?	none, except for Carson program	
	Annual number of adult summer/fall Chinook returning to intended return location compared to number returning to unintended dams, fisheries, hatcheries, and natural production areas.	Index areas adjacent to and at the release sites will be established. Marking program will allow individual groups to be distinguished.	In addition to ongoing annual carcass counts and aerial survey, CCT will assess changes in spawning distribution by implementing a five-year rotating panel design with x reaches per year monitored.	PSC/PST (CRITFC and State of AK). Use WDFW catch record card estimates and samples of adult CWT codes collected during creel surveys and redd counts to estimate the return and sport harvest of all groups of released Okanogan and mainstem UC origin Chinook within the CJD central facility and Okanogna River areas of

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
Juveniles are released at fully smolted stage.	For each release group, the annual level of smoltification at release, compared to a regional smoltification index (to be developed).	Numbers of adult and juvenile salmon in the reach. Abundance of salmon can be determined using both adult spawner and redd counts and juvenile counts. Both adults and juveniles will be monitored using protocols developed by Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife. Adult estimating procedures are found in Protocol 9. Juvenile estimating procedures are found in Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per mile or redds per mile for adults depending upon the target species. Pre-project costs include a foot reconnaissance survey to determine the location of the blockage, and the linear distance upstream to be benefited by the project. It would also include laying out the randomized sampling reaches and obtaining measures of the wetted usable area within the sampled stream reaches. A snorkeling, electrofishing, or beach seine survey should be con	none	PSC/PST (CRITFC and State of AK). Use WDFW catch record card estimates and samples of adult CWT codes collected during creel surveys and redd counts to estimate the return and sport harvest of all groups of released Okanogan and mainstem UC origin Chinook within the CJD central facility and Okanogna River areas of Washington.
	For each release group, the annual type of release (volitional, forced, or direct stream release).	Numbers of adult and juvenile salmon in the reach. Abundance of salmon can be determined using both adult spawner and redd counts and juvenile counts. Both adults and juveniles will be monitored using protocols developed by Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife. Adult estimating procedures are found in Protocol 9. Juvenile estimating procedures are found in Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per mile or redds per mile for adults depending upon the target species. Pre-project costs include a foot reconnaissance survey to determine the location of the blockage, and the linear distance upstream to be benefited by the project. It would also include laying out the randomized sampling reaches and obtaining measures of the wetted usable area within the sampled stream reaches. A snorkeling, electrofishing, or beach seine survey should be con	Downstream trapping programs will provide data.	WDFW annual reprots from Similkameen, Ellisforde.
The number of adults returning to the hatchery that exceeds broodstock needs is declining	Annual number of adults available for broodstock (moving geometric mean, based on number of ages at return for this ESU).	Fish will be collected at the hatchery weir and at the mouth of the Okanogan River, Omak Creek or other acclimation and/or spawning reaches across the spawning run. Specific sex ratios and number of HvW fish will be established based upon broodstock collection protocol as per YKFP model (MIPT 1997), and/or HGMP. Modifications to Wells program and possibly Eastbank and Turtle Rock.	Adult fish collected in the baseline program will contribute to this metric	
Research Activities:				

Attachment 1. Summer/Fall Chinook - Relationship of Performance standards and Associated Indicators to Hatchery Specific, and Okanogan Basin, M&E Activ

PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.	All program research employs scientifically based experimental design, with measurable objectives and hypotheses.	The ISAB in its 2000 report to NPCC cite a number of unanswered questions that persist around the topic of supplementation. Many of these questions are being addressed in the Imnaha, Yakima, Deschutes, Tucannon and other river systems in the Columbia Basin. Most of these questions require formal and rigorous experimental design that requires immense infrastructure and major funding. This conceptual M&E plan will rely on the results from existing programs to answer the following questions	Okanogan Baseline	PNAMP, CSMEP, UC Monitoring Strategy, State of Washington Comprehensive Monitoring Strategy, Intensively Monitoring Watersheds (e.g., Wenatchee, Hood Canal)
The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.	The program's annual Monitoring & Evaluation Plan addresses this HGMP's performance standards through measurement of the Plan's indicators.	Research related to artificial production program throughout the Columbia Basin will be reviewed to ensure that programmatic activities within the CJD Hatchery Program are: 1) consistent with the best available science, and 2) compliant with new and updated standards. Program staff from the CJD Hatchery Program will participate in annual symposia and program report sessions with staffs from other basin supplementation facilities to ensure that CJD Hatchery activities use standard scientific procedures including scientifically based experimental design with measurable objectives and hypotheses and are capable of evaluating various aspects of the artificial propagation program. Findings pertaining to program benefits and risks may be presented at AFS meetings, regional performance reviews, and when appropriate, in peer-reviewed scientific journals. See conceptual and final M&E plans, HGMP, PCSRF and NOAA Recovery Guidelines incorporated into this plan	none	
	Annual M&E reports are submitted and made readily available for the public and scientific community.	Each November the Hatchery M&E Coordinator or Committee will present results from all M&E activities to the Upper Columbia Regional Technical Team and to the Hatchery Steering Committee. Presentations to the American Fisheries Society's North Pacific International Chapter at their Annual General Meetings, PNAMP and CSMEP. The CJD project was developed by the Colville Tribes and a growing number of partners such as WDFW, the Bureau of Reclamatin, BPA, NPCC and the Army Corps of Engineers. All Program activities require extensive coordination among comanagers. Coordination is and will continue to be accomplished through regularly scheduled meetings, frequent informal consultations, and document preparation, submittal and review. CJD Hatchery Steering Committee meetings in December and January are the primary forums for Project coordination and planning. The resulting Master Plan is the document serving as the primary descriptor of specific O&M and M&E methods, actions, procedures and delegation of responsibilities for the	Each November the Baseline M&E Coordinator or Committee will present results from all M&E activities to the Upper Columbia Regional Technical Team. Presentations to the American Fisheries Society's North Pacific International Chapter at their Annual General Meetings, PNAMP and CSMEP.	

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PERFORMANCE	INDICATORS	RELATED HATCHERY SPECIFIC M&E ACTIVITIES	RELATED OKANOGAN BASIN	OTHER (Other monitoring
	Findings pertaining to program benefits and risks are presented at AFS meetings, regional performance reviews, and when appropriate in peer-reviewed scientific journals.	Presentations to the American Fisheries Society's North Pacific International Chapter at their Annual General Meetings. Submissions of selected study results will be submitted for peer review and Journal publication based upon funding and resources available to the program. : Several forms of analysis will be required as data are gathered for this project. Statistical tests, design components, database management architecture, and various reporting format requirements are things the sponsor will take into consideration. A data management protocol will be established following the general outline described under objective No. 14.	Presentations to the American Fisheries Society's North Pacific International Chapter at their Annual General Meetings. Submissions of selected study results will be submitted for peer review and Journal publication based upon funding and resources available to the program.	
Operation of Artificial Production Facilities:				
Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD.	Compliance with guidelines, standards, and protocols are reported in annual reports.	Monthly monitoring and annual reports will be developed and provided to IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD. Rearing protocols will be monitored for patterns of mortality in terms of deviation from randomness. Acclimation raceways, volitional release will also be monitored in this context. Fish Disease Outbreaks The fish health specialist will respond to all fish disease outbreaks at the request of the fish hatchery staff. The fish health specialist will visit the CJD hatchery facilities at least once a month. Mortality records and fish in all rearing containers will be inspected. Approximately 12-15 fish of each species will be killed and examined at the discretion of the fish health specialist. At spawning, all broodstock will be annually tested for viral pathogens. All spawned female fish will have ovarian fluid sampled and tested. Additionally, 60 fish will have kidney/spleen samples taken and sampled for viral pathogens. Specific Fish Health Management 1. Bacterial Kidney Disease (BKD) Management a. All female chinook broodstock will receive a pre-spawning i b. All female chinook broodstock will be tested for BKD via EL c. Juvenile chinook may be reared separately based on the BI d. All juvenile chinook will be reared at a density index of less e. Prophylactic feeding of erythromycin may be employed. 2. Broodstock and Egg Fungus Management a. Broodstock - All chinook broodstock will be treated with forr b. Eggs - All eggs will be treated with formalin daily to control	Monitoring at Omak Creek trap and weir, Slamon Creek trap, Enloe dam and all acclimation sites that fall within EMAP sites	USFWS, NOAA Carson Stock Agreement and program in Omak Creek. Reintroduction of Sockeye into Skaha Lake (CCT. ONA)

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	Periodic reviews and audits are conducted, particularly in the programs' early years.	Each year presentations to the Hatchery Steering Committee, BPA, NPCC and other appropriate individuals or entities. Submissions of selected study results will be submitted for peer review and Journal publication based upon funding and resources available to the program. This hatchery evaluation plan is closely coordinated with the Okanogan Baseline Monitoring and Evaluation Plan (Baseline Plan) which will begin in 2004. Both plans will therefore combine to provide the necessary information for determining the success or failure of production programs in the Okanogan river basin. The Baseline Plan uses EPA's EMAP protocol and is further derived from the BPA-funded M&E Pilot Study developed for the Wenatchee subbasin (and subsequently adopted by all six subbasins in the Upper Columbia). The Okanogan Baseline Plan has been reviewed and strongly endorsed by the ISRP as "the model for the Columbia basin", and by the NPCC, is funded by BPA, and will be implemented by the Colville Tribes Fish and Wildlife Program staff and other regional experts.Project staff, resources, and data will be shared betwe	This hatchery evaluation plan is closely coordinated with the Okanogan Baseline Monitoring and Evaluation Plan (Baseline Plan) which will begin in 2004. Both plans will therefore combine to provide the necessary information for determining the success or failure of production programs in the Okanogan river basin. The Baseline Plan uses EPA's EMAP protocol and is further derived from the BPA-funded M&E Pilot Study developed for the Wenatchee subbasin (and subsequently adopted by all six subbasins in the Upper Columbia). The Okanogan	USFWS, NOAA Carson Stock Agreement and program in Omak Creek. Reintroduction of Sockeye into Skaha Lake (CCT. ONA)
Effluent from artificial production facilities will not detrimentally affect natural populations.	Discharge water quality at each propagation facility annually compared to applicable water quality standards and guidelines in IHOT, PNFHPC, and the Co-Managers of Washington Fish Health Policy.	Monthly monitoring and annual reports will be developed and provided to IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD. NPDES permits from DOE will be obtained and compliance monitoring will be conducted in accordance with this permit.		
Water withdrawals and in-stream water diversion structures for artificial production facility operations will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact	Water withdrawals compared to WDFW adult passage criteria.	Central Facilities and all acclimation sites will conduct Biological Assessments for permitting applications to be submitted to the state of Washington Department of Ecology and to NOAA Fisheries. The Bureau of Reclamation, individual irrigation districts and the Army Corps. of Engineers will also be consulted	Project staff, resources, and da	Okanogan Water Strategy
	Water withdrawals compared to NMFS juvenile screening criteria.	Central Facilities and all acclimation sites will conduct Biological Assessments for permitting applications to be submitted to the state of Washington Department of Ecology and to NOAA Fisheries. The Bureau of Reclamation, individual irrigation districts and the Army Corps. of Engineers will also be consulted	Screening of all diversions is monitored as part of the EMAP design and ongoing EDT analysis. Consultation with WDFW's screen shop and TAPPs program will be part of the baseline program	TAPPS (formally SSHEAR) is conducting an inventory of all barriers with analysis of FPE in 2004-2005.
	Annual number of summer/fall Chinook aggregating or spawning immediately below water intake.	Mainstem and selected acclimation sites will be monitored in a statistically derived subsample (No. of days + No. of sites) to determine spatial distribution.	Baseline program is a randomized and spatially balanced design. Some index reaches may fall into same reach as hatchery acclimation	
	Proportion of diversion of average monthly stream flow between intake and outlet for each hatchery facility.	Measured as part of hatchery facilities monitoring at both the central facility and at all acclimation sites	none	

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Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	Annual certification of juvenile fish health immediately prior to release, including pathogens present and their virulence, for each release site.	Monthly monitoring and annual reports will be developed and provided to IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD. NPDES permits from DOE will be obtained and compliance monitoring will be conducted in accordance with this permit. Externally marked strays will be removed at the adult trap and the carcasses returned to the stream for nutrient enhancement. All other fish were passed upstream for natural spawning. Adults collected for broodstock will be injected at transfer with oxytetracycline and erythromycin and with erythromycin every 30 days thereafter. Adults will receive formalin treatments every-other day to control fungus and decrease pre-spawning mortality as needed.	none	
	Periodic samples of natural-origin fish for disease occurrence.	All natural origin broodstock, egg, fry, parr and smolt will be sampled on a daily basis. Monthly annual reports will be developed and provided to IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD. Mortalities and disease (e.g., IHN) will be reported. Specially, all lots of fish are monitored for fish health, all broodstock are annually inspected, strict hatchery sanitation procedures and fish culture practices (rearing criteria) are followed, and egg and fish transfer and release requirements are met. In addition, bacterial kidney disease management strategies for chinook salmon stocks and infectious hematopoietic necrosis management strategies will be employed.	Adult fish collected in the baseline program will be examined for outward signs of disease.	
Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution	Annual number and locations of carcasses distributed for nutrient enrichment.	Location and timing of all releases will be coordinated with WDFW and USFWS. Numbers and placement will follow Cederholm et al. Subsamples of carcasses will be examined for viruses, pathogens and disease prior to use in streams.	Carcass surveys in ongoing index areas. Broodstock collection and selective harvest program will provide indices for nutrient levels and assist in determining if carcass enhancement is warranted. BACI design studies on growth rate and survival may be included in baseline program if	Joint Fishery Parties and the mid-Columbia Coordinating Committee
	Statement of compliance with applicable regulations and guidelines.	Monthly monitoring and annual reports will be developed and provided to IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, and INAD.		
Adult brood stock collection does not significantly alter spatial and temporal distribution of any naturally produced population.	Spatial and temporal spawning distribution above and below weir/trap compared to historical distribution.	Collect information from all broodstock collection program and selective harvest sites consistent with provisions of Section 10(a)(1)(A) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531-1543), the National Marine Fisheries Service (NOAA Fisheries) regulations governing ESA-listed species permits (50 CFR Parts 222-226).	none	Joint Fishery Parties and the mid-Columbia Coordinating Committee

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Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	Annual mortality rates in each broodstock collection facility.	Collected daily, monthly and annually as part of facilities program.	As part of adult collections in conjunctino with broodstock collection. Surveys in Omak and Salmon Creek for adults and at all EMAP sites on rotating panel.	
	Annual prespawning mortality rates of trapped fish in the hatchery or after release.	Collect information from all broodstock collection program and selective harvest sites consistent with provisions of Section 10(a)(1)(A) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531-1543), the National Marine Fisheries Service (NOAA Fisheries) regulations governing ESA-listed species permits (50 CFR Parts		
	Annual mortalities of non-target Chinook, sockeye, and steelhead affected by operation of broodstock collection facilities.	A Non Target Taxa of Concern Program is part of the overall Ecological Interactions section of the CJD Hatchery M&E Plan. : Artificial production facilities will be operated in accordance with established fish health guidelines and facility operational standards and compliance will be monitored. Effluent from artificial production facilities, water withdrawal structures and in-stream water diversion structures will be inspected to verify that these are not detrimentally affecting natural populations (prevent access to natural spawning areas, affect spawning behavior of natural populations, impact juvenile rearing environment, etc.). Protocols will be developed for weir/trapping operations to minimize stress, injury, and/or mortality to natural populations. Fish will be examined by a professional pathologist in accordance with established fish health guidelines to verify that releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. This will include annual certification of juvenile fish health immediate	Indexing of all species present in EMAP index areas. Snorkeling, electofishing and trapping will provide index.	
Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	Size at, and time of, release of hatchery-origin fish compared to size and timing of natural-origin Chinook and steelhead present.			Joint Fishery Parties and the mid-Columbia Coordinating Committee
	Number of fish in stomachs of sampled hatchery-origin fish in the Okanogan River, with estimate of natural-origin fish composition, and estimate of total consumption of natural-origin fish.	As part of recommended Predator Index studies for Okanonga Lower Assessment Unit. IN: 2004 Okanogan Subbasin Plan. Hatchery M&E could act as basis for these studies as recommended in subbasin plan.	As part of recommended Predator Index studies for Okanonga Lower Assessmetn Unit. IN: 2004 Okanogan Subbasin Plan if not in Hatchery M&E	As part of recommended Predator Index studies for Okanonga Lower Assessmetn Unit. IN: 2004 Okanogan Subbasin Plan.
Socio-Economic Effectiveness:				

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Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population or does not exceed other available options to provide fish to satisfy tribal trust responsibilities.	Total cost of program operations.	Annual costs and benefit audit. Initial and every four years, a value engineering audit will be conducted. Total program and component costs will be determined and compared to monetary and non-monetary societal program benefits. Cost of feasible and available alternatives to provide similar or better tribal harvest for Colville Tribes and other tribes will also be evaluated. Juvenile production costs will be calculated and compared to other regional programs designed for similar objectives to verify program cost efficiency. Strategies will be developed to increase harvest opportunities for all fishers consistent with requirements of genetic, natural production, and experimentation objectives of this program. These will include development of selective and/or "status- index harvest" policies to increase opportunity for all fisheries in the Upper Columbia including the Okanogan basin).	none	
	Sum of ex-vessel value of commercial catches and monetary value of recreational fisheries targeting these summer/fall Chinook (based on proportion of summer/fall Chinook in harvest).	Monitoring of PFMC, US/Canada, PST and North of Falcon processes. Results from objective tasks, will be assembled into species specific report and made available in printed and electronic formats.	Baseline will collect all applicable data for estimating catch, CPUE. Creel programs and both CCT and WDFW annual reports will be used to calculate increase in fisheries opportunity and estimate value to tribes, state and public.	UC Recovery Plan
	Cost of feasible and available alternatives to provide similar or better tribal harvest for CCT and other tribes.	As part of Master Plan process only.	none	
	Total CCT harvest and harvest by other tribes.	As part CCT and WDFW creel. Annual reports from WDFW and CCT F&W will provide basis to report this metric.	none	2004 Okanogan Subbasin Plan, 2005 Upper Columbia Recovery Plan.
Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Total costs of each summer/fall Chinook program release component.	Annual costs and benefit audit. Initial and every four years, a value engineering audit will be conducted	none	UC Recovery Plan
	Average and representative costs for similar hatchery programs.	Annual costs and benefit audit. Initial and every four years, a value engineering audit will be conducted to include comparison with YKFP, NEOH, Nez Perze, Umatilla.	none	UC Recovery Plan
Non-monetary societal benefits for which the program is designed are achieved.			none	UC Recovery Plan
	Number of summer/fall Chinook available for CCT ceremonial and subsistence use.	As part CCT and WDFW creel. Annual reports from WDFW and CCT F&W will provide basis to report this metric.	none	UC Recovery Plan
	Annual number of recreational angler days and length of seasons in fisheries targeting the program's summer/fall Chinook.	As part CCT and WDFW creel. Annual reports from WDFW and CCT F&W will provide basis to report this metric.	none	2004 Okanogan Subbasin Plan, 2005 Upper Columbia Recovery Plan.
	Length and geographic extent of tribal fishing seasons targeting program's summer/fall Chinook.	As part CCT and WDFW creel. Annual reports from WDFW and CCT F&W will provide basis to report this metric.	none	2004 Okanogan Subbasin Plan, 2005 Upper Columbia Recovery Plan.
	Number of tribes participating in harvest of program's summer/fall Chinook.	As part CCT and WDFW creel. Annual reports from WDFW and CCT F&W will provide basis to report this metric.	none	2004 Okanogan Subbasin Plan, 2005 Upper Columbia Recovery Plan.

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** Performance standards and performance indicators are from the draft, "Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific N*				

Ongoing M&E activities in the UC

Agency	Juvenile/Adult/Redd Counts/Escapement etc.	Subbasin	HUC, RM, Lat:Long?	Time of Year	Method	Time Series
BPA	Measure Mine Drainage Effects of Alder Creek	Methow	Methow River and Alder Creek		Analyze leachable metals, riparian vegetation, benthic index of biotic integrity	
BPA	Watershed Scale Response of Stream Habitat to Abandoned Mine Waste	Methow	Alder Creek, Methow River	Seasonal	Analyze metal uptake, transfer and hazards in food web	
CCT	Juvenile/Adult/Redd Counts/habitat surveys	Okanogan	Omak and Salmon Creeks	Omak and Salmon Creeks	Trapping, redd surveys, snorkel surveys, habitat surveys	3 years in Omak Creek, 1 year in Salmon Creek. Habitat surveys have been conducted over a 10 year period
CCT	Colville Fish Hatchery Monitoring and Evaluation Program	Upper Columbia				Program has been in place since 1998.
CCT	Design and Conduct Monitoring and Evaluation Associated With Reestablishment of Okanogan Basin Natural Production	Okanogan				
CCT	Evaluate An Experimental Re-introduction of Sockeye Salmon into Skaha Lake	Okanogan			Assess risks, benefits, formulate hypotheses, develop experimental design and analytical tools	2001-2002
DCPUD	Adult sockeye escapement	Upper Okanogan		October - November	Peak live count	Since 1938
DCPUD	Sockeye/kokanee redd scour/ desiccation monitoring	Upper Okanogan		October - March	Elevation transects, profile models and stream gauge monitoring	Since 2001
DCPUD	Juvenile chinook/steelhead trapping w/ WDFW	Upper Methow		Spring and Fall	Screw traps	Sporadically since 1993. New project begins in 2004 with spring, summer and fall screw trapping
DCPUD	Steelhead redd surveys/escapement w/ WDFW	Methow Basin		March - June	Index spawning ground surveys	Pilot year 2000 with full index surveys starting in 2001. Surveys completed in 2002 and 2003 and will take place in 2004.
DCPUD	Spring Chinook redd/escapement monitoring w/ WDFW	Methow Basin		August - September	Redd counts and carcass surveys	Starting in 1993 with no surveys in 1996 and 1998 (following collection of all adults at Wells)
DCPUD	Juvenile steelhead residualism assessments w/ WDFW	Methow Basin		Summer	Angling for the presence of residual/marked hatchery steelhead	Conducted sporadically since 2000.
DCPUD	Bull trout/cutthroat counts by WDFW	Methow	Tributary Brood traps	May - August	Adult counts via tributary trapping	Bull trout/cutthroat counts have been kept for the past three years (2001, 2002 and 2003)
DCPUD	Methow Hatchery Evaluation w/ WDFW	Methow	Methow River	Ongoing		1990 to present

Ongoing M&E activities in the UC

DCPUD	Temperature Monitoring	Methow, Okanogan	Only backwater portions of reservoir.	May - November		1998 to present
DCPUD	Bull Trout Movement/Migration	UMC, Methow, Okanogan		all year	Telemetry	2001 to present
DCPUD	Adult steelhead telemetry	UMC, Methow, Okanogan		July - June		1998-1999 and 2001-2002
DOE	Stream Biological Monitoring	Methow				1997-1998
DOE	Methow River Water Quality Survey and Assessment	Methow				
DOE	Survey of Metal Concentrations in the Similkameen River	Okanogan	From Canadian border to confluence with Okanogan River			
DOE	Similkameen River Arsenic	Okanogan				
DOE	Similkameen River Sediment Quality Data Review					1995-1999
DOE	Okanogan River DDT/PCB TMDL Assessment					1995-1999
Okanogan Conservation District, Department of Ecology	Basin Wide Water Quality Assessment	Okanogan				2000-2003
Pacific Watershed Institute, Methow Valley Reclamation District	Restoration Monitoring	Methow			Evaluate re-vegetation success, LWD, channel geometry, sediment, habitat condition, hydrology, fish presence.	
USFS	Temperature Monitoring	Methow	87 sites (list available)	June-Oct	Continuous data loggers. Some longitudinal profiles incl Chewuch, Twisp, Goat, L Bridge.	One site 1996-present; 8 sites 2-4 yrs record; remainder 1-2 yrs record
USFS	Temperature Monitoring	Okanogan	17 sites (list available)	June-Oct	Continuous data loggers.	1-2 yrs record
USFS	Sediment Monitoring	Methow	Chewuch and Twisp, 4 reaches each (details avail)	Annually low flow	McNeil. 12 samples per riffle.	Chewuch 2000 to present; Twisp 2001 to present.
USFS	Bull Trout Redd counts	Methow	About 35 miles annually in cooperation with USFWS. Includes Twisp and tribs, Upper Methow and tribs, Early Winters and tribs, Chewuch, Lake, Wolf, and Crater. (Some data Lost, Libby, Monument.) Report avail.	BT spawning	Redd survey (2-3 visits)	1995-present
USFS	Steelhead Redd counts	Methow	9 index reaches and 7 tributaries; report available	Mar – Apr	Weekly visits	2001 to present
USFS	Snorkel surveys	Methow	Numerous; previous reports available. 2004 may include Beaver Ck.	variable	Standard or draft BT detection protocol	variable
USFS	Snorkel surveys	Okanogan	Previous data available. 2004 snorkeling may include Toats Coulee and Salmon Ck and tribs.	variable	Standard or draft BT detection protocol	variable

Ongoing M&E activities in the UC

USFS	Habitat surveys	Methow	Numerous; map of surveyed reaches, reports, available. 2004 may include Beaver Ck.	Low flow	Hankin-Reeves	variable
USFS	Habitat surveys	Okanogan	Numerous; map of surveyed reaches, reports, available. 2004 may include Toats Coulee.	Low flow	Hankin-Reeves	variable
USFS	Recreation / Restoration Monitoring	Methow	Numerous; annual reports available	summer	Respect the River	1994-present
USFS	Restoration Monitoring	Okanogan	Numerous. 2004 may include Jimmy's Meadow.	See reports	See reports	See reports
USFS	Grazing monitoring	Methow	Beaver, Wolf, others. Reports available	See reports	See reports	See reports
USFS	Culvert survey	Methow, Okanogan, Wenatchee, Entiat, Yakima	Most culverts on fish-bearing streams on Okanogan - Wenatchee NF. Database avail.	Low flow	Details avail	2000 to present
USFS	Flow monitoring	Methow	About 5 sites. Reports available.	April - Oct	Related to ditch operations	1999 to present
USFS	Mule Deer Studies	Methow, Entiat, Wenatchee			Radio-collar monitoring	1970s, 1980s, late 1990s
USFWS	Chinook Adult Hatchery Evaluation	Wenatchee Entiat Methow	Leavenworth NFH Entiat NFH Winthrop NFH	May - September	Hatchery Rack	Annually
WDFW	Summer chinook supplementation program evaluation	Methow			Monitoring and evaluation of the efficacy of supplementation efforts	
WDFW	Adult steelhead migration and spawning disposition	Methow		Throughout spawning and migration	Radio-telemetry	
WDFW	Species Abundance and Distribution	Methow		Annual & periodic	Distribution abundance survey	
WDFW	Creel Census Survey Information	Methow		Annually during trout fishery		
WDFW	Lynx Research	Methow				1980s
WDFW	North Cascades Rare Carnivore Camera Survey	Methow		Ongoing	Self-activated cameras	
WDFW	Townsend's Big-eared Bat	Methow				
WDFW	Grizzly Bear/Gray Wolf Investigations	Methow				
WDFW	Forest Carnivore Survey	Methow				
WDFW	Wolverine Investigations	Methow				
YN	Monitoring and Evaluation for Douglas PUD	Methow			Spring chinook abundance estimates (snorkel) and smolt abundance (screw traps)	
YN	Methow Basin spring chinook spawner surveys	Methow	Basin-wide	Fall	Spawner surveys	1987-ongoing
YN	Methow Basin Spring Chinook Salmon Supplementation Program (MBSCSP)	Methow				1993-ongoing

Ongoing M&E activities in the UC

YN	Mid-Columbia Coho Feasibility Reintroduction Study	Methow			M&E focus on success of broodstock development, associated survival rates, species interactions	1996-ongoing